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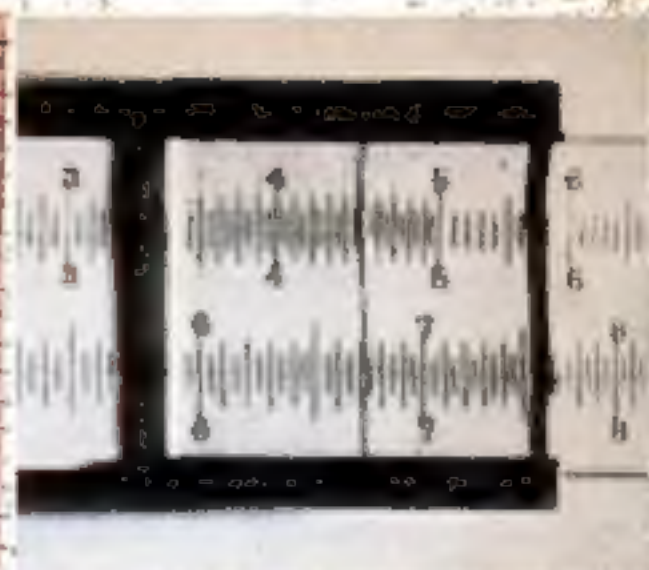
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Gamblers' tricks: *Bones like this bring home the bacon. P. 61*

Timesavers: *How to use every hour to enlarge every day. P. 117*

Slide rule: *The easy way to tough figuring. P. 94*

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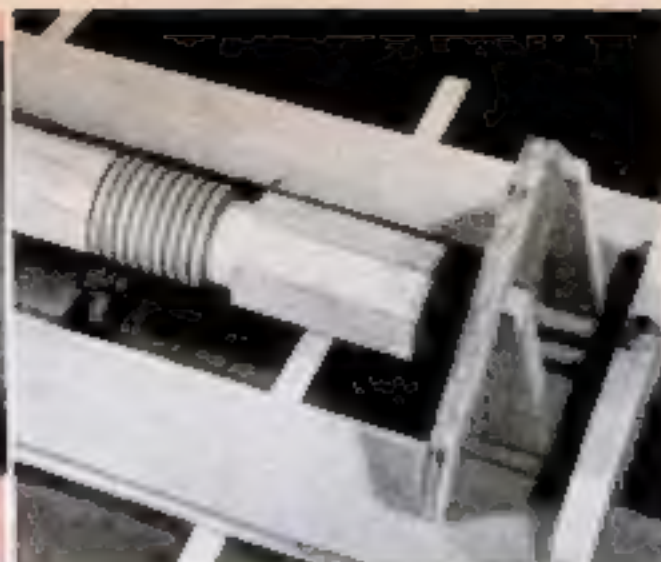
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NEXT MONTH

Another big 90th Birthday Bonus Issue! It's crammed with useful, entertaining articles PLUS a special 28-page section on the wonderful world of electronics . . . news about kits, color TV, stereo, garage-door closers, car radios . . . and lots more . . . in Feb. PS.

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PS Readers

TALK BACK



Saving Rameses' Temples

ABOUT your piece on saving Rameses' temples ["Hydraulic Jacks Will Raise Mountain to Save Rameses' Temples," Oct., p. 122]: Why not use the enormous water pressure of the dam to lift the temples? This could be accomplished by tunneling from under the temples to the deepest part of the dam. Then individual high-pressure pipes could be run from the dam to the temples in such a way that each pipe would supply water pressure to individual hydraulic jacks.

These jacks should not have 1,000-lb. lift, as has been suggested, but 500, or even less. The lower lift pressure would require more jacks, but would provide more even pressure. This is an advantage, since the mountain structure is reported to be unstable.

The operation could be controlled with appropriate valves on the pipes. As the level of the dam rises, the pressure increases, raising the temples. At no time would the temples be below the level of the water behind the dam structure. As the temples rise, concrete can be poured under them as a safety precaution.

REEVE WIELAND, Newark, Del.

Tear-Outs Make a Hit

I WOULD like to tell you how much I enjoyed and profited by the "Save-It Section" on clutches and transmissions for small machines [Oct., p. 147]. I think that this particular article was worth the price of a year's subscription.

R. B. KELLER, Ann Arbor, Mich.

... LET me say that I think your magazine, like good whiskey, gets better with age.

The tear-out section is extremely well done and I hope you don't allow it to become too professional. Please keep it so that those of us without too much talent can utilize it.

J. T. DORMAN, Durham, N.C.

Pity the Poor Police

I DOUBT the worth of that radar warning device ["\$40 Gadget Spots Police Radar—But . . .," Sept., p. 61] in my state. An Ohio motor-vehicle law provides that a warning sign must be placed between 750 and 1,500 feet ahead of any radar or speed-timing device or the evidence will be judged incompetent. It seems to me that this renders radar useless, outwitting its purpose. I think it is a ridiculous law.

JIM TAKAS, Chagrin Falls, Ohio.

... "GADGET Spots Police Radar—But" [Sept., p. 61] is an affront to the system under which we live. It's a mistake to give this free publicity to a device that allows people to defy our laws.

AIC T. P. MADDOX, APO, N.Y.

Backtalk For and Agin Detroit

THE paper spent for "Auto Makers Answer Back on Car Safety" [Oct., p. 89] so Detroit could say "Well, you see, it's this way" only helped the paper mill.

Last year traveling in our 1960 station wagon, we had six luggage cases behind the back seat. Traveling about 60 on a four-lane road, I gave the foot brake the works when a car in the other lane cut in. Cargo came

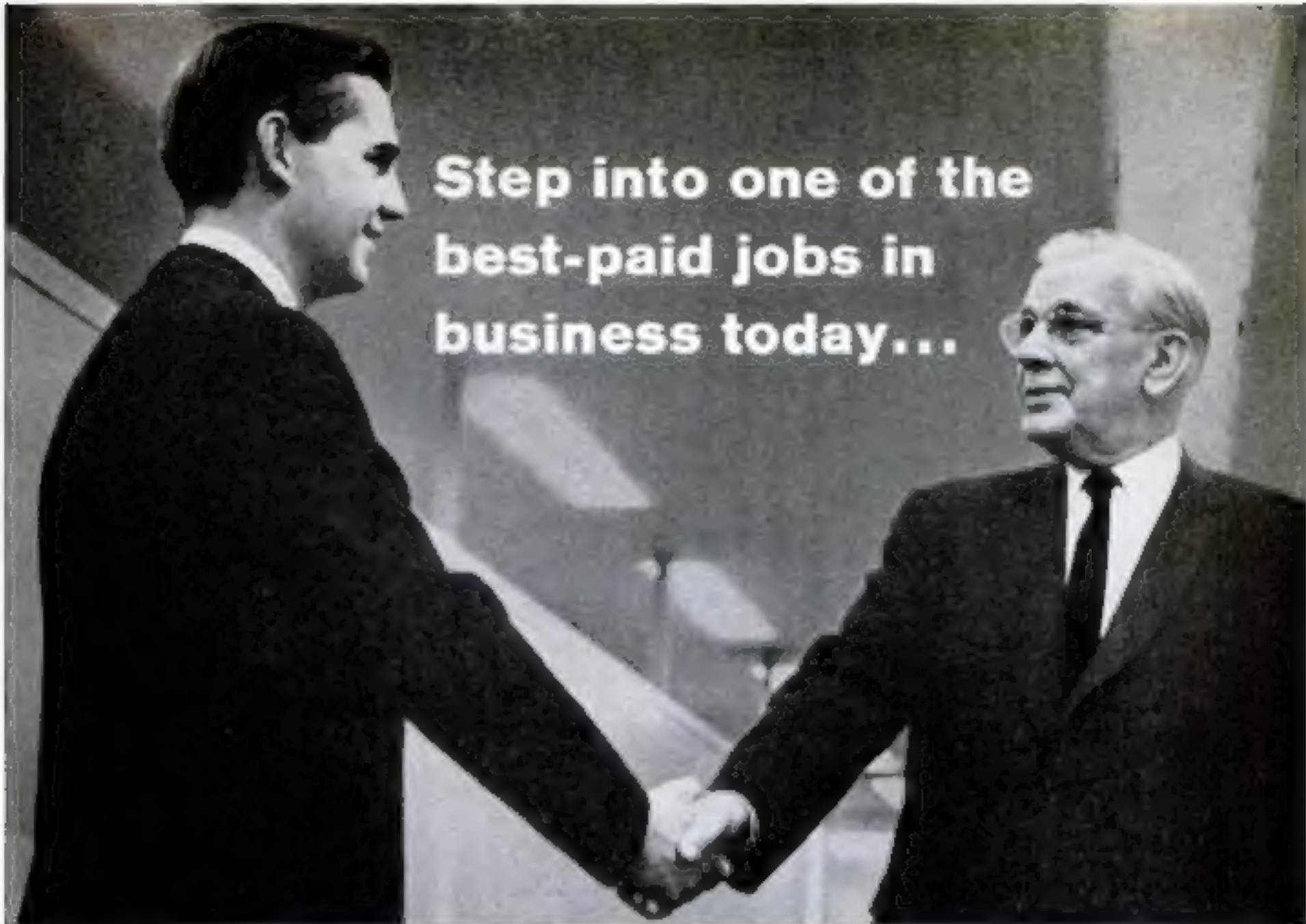


forward, shoving the back seat forward out of its little kiddie-car catches and badly injuring the dog on the back seat.

With that \$100,000,000 test ground "they all use," were such tests made with the wagon? Do you dare ride two pint-size kids or a baby on that seat with any cargo aboard? Someone ask them that. Give 'em hell!

H. K. WITTNER, Seattle.

... DETROIT's answer to "Why Cars Aren't Made Safe" [Sept., p. 45] was excellent. Your piece was illogical and contradictory. In one breath you cite a need for high-backed seats with head supports while in the next you cite a lack of road visibility. You ignore the effect of law enforcement and



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driver education in reducing accidents. Your most illogical recommendation is federal regulation. As Mr. Williams pointed out so well, competition among the car manufacturers will provide the greatest advancement in car safety.

W. C. STEIGER, Cincinnati.

... OF COURSE you were exaggerating when you said, "Anchorage" means four extra holes." There is more than just the holes for the belts. But I will say this: The industry could hardly have done less and it was kicked into it by the New York Legislature.

I agree with your remark about "chrome-plated stilettos so malevolently aimed at heart, brain, and legs." After all that has been said on car safety by the medical profession, after all the formal resolutions sent to the industry by medical groups, structures in the '62 models that flout all these recommendations indicate a very real malevolence in the design echelon.

HORACE E. CAMPBELL, M.D., CHAIRMAN
Automotive Safety Committee
Colo. State Medical Society, Denver.

... LIKE New York's safety-belt legislation, it was state-enacted laws that compelled use of safety glass in cars back in the thirties.

GEORGE SMITH, Madison, Wis.

... I WONDER why it would not be practical to build cars with safety belts that would fasten to the doors and pass in front of the passengers at a higher level than a floor-fastened belt? Such belts would be non-adjustable and made to retract into the door panel when not in use.

They'd keep the doors from springing open in a crash, would accommodate any number of passengers, and would support the body so as to minimize forward movement. They'd also let a fellow get his hands into his pants pockets while driving.

E. N. HERR, Hickory, N.C.

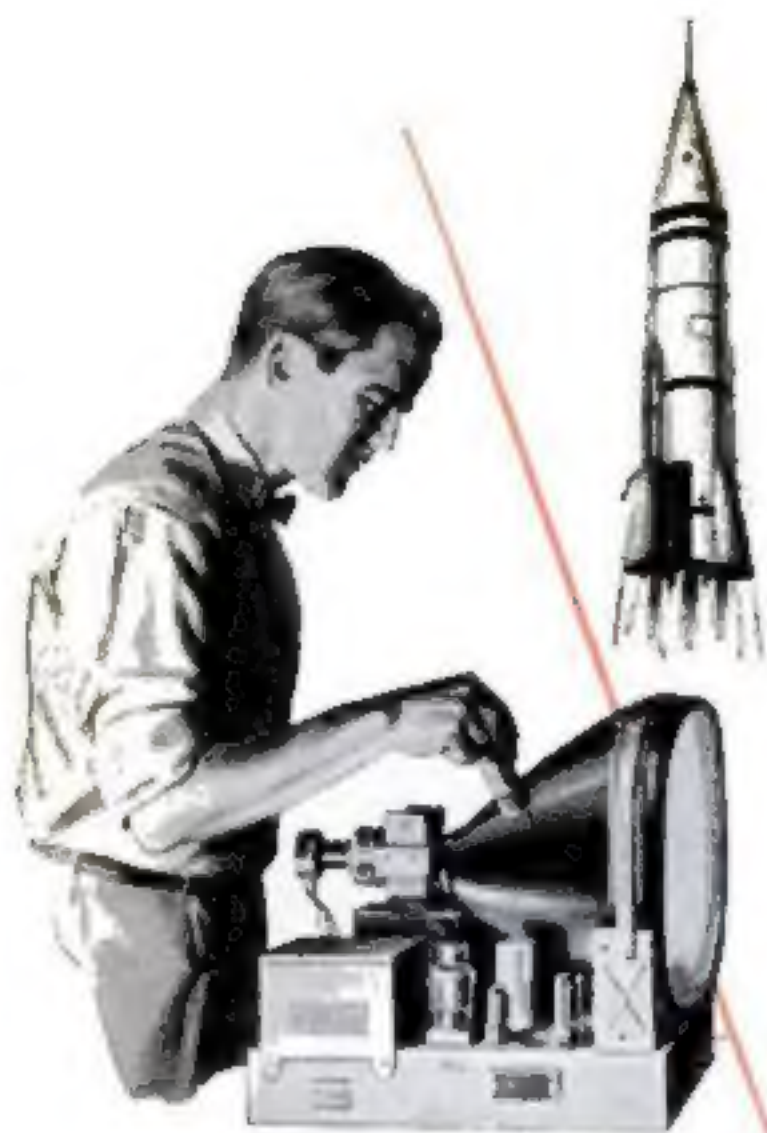
Don't Clutter Up Davey Jones' Locker

I WAS amazed at your suggestion that boatmen puncture beer cans at both ends



and throw them in deep water ["Boating Hints," Oct., p. 164]. That will get you a \$25

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How to think a full-size car into 197 inches



The new Ford Fairlane 500 is so beautifully logical you may think it was easy to design. But to enclose big-car room, ride and performance inside a handy 197 inches—that demanded the most imaginative engineering of the decade!

The day Ford engineers started sketching out the Fairlane for 1962, they began the most intricate project of their careers. For the Fairlane was not to be another compact car (a thorny enough problem) but a *full-size* car inside 197 inches of total over-all length.

It had to be lean and nimble outside to suit today's traffic. But it absolutely could not give up the stretch-out room *inside*—the "tall" seats that are so comfortable on long journeys, the extra leg room for long-shanked drivers, the easy-fitting space for six, the cavernous trunk capacity Americans truly need. And, above all, it could not shade by a hair the "feel" of Ford full-size quality—the velvet ride, the silence, the innate craftsmanship. Or the punch and sparkle of full-size performance. One more thing: Fairlane had to have the twice-a-year maintenance schedule introduced by the Galaxie.

First step—unitized body

The thinking began with unitized body construction—stronger because it becomes a single welded unit, lighter because there is no heavy frame. That saved hundreds of pounds, and permitted smaller engines (they could give the same performance with less power—and less gas—because there wasn't so much weight to lug around). Unitized construction also produced full-size room within the Fairlane 500's trim new dimensions.

The "Watchmaker's" V-8

They thought up a new engine to go with the standard 101 horsepower 6—a new V-8 with only 221 inches of displacement, an easy 8.7 compression ratio for regular gas—and 145 cream-smooth horsepower. Motor experts predict this will be one of the great "classic" engines of our time. Molded in time-tested cast iron, it uses Ford-pioneered "precision-cast" foundry techniques to pare weight to only 450 pounds complete. Extremely short stroke (2.87 inches), separately mounted shell-cast rocker arms for lightweight valve train, outer-end counter-balancing and hydraulic valve lifters give dynamo smoothness at the highest r.p.m. No two exhaust valves are side-by-

side to build up a hot spot. And typical of the basic sturdiness is the fact that the "valley" cover is *cast* as part of the intake manifold, not stamped metal (less noise, better oil seal). The result is a new kind of engine—one that blends V-8 smoothness and sparkle with six-cylinder thrift.

"Torque Box" Isolation

Fairlane engineers also thought up a new way of putting velvet into the ride—"torque boxes" welded between the members that hold the suspension and the main body itself. These look like boxes of sheet metal—but they are "tuned" to a subtle, precise degree of flex. Like the plastic-sheathed shank of a golf club they take the sting out of any tiny road vibrations that get past Fairlane's sophisticated suspension system—and they also break the cycle of road noise before it telegraphs into the body. Add this to Fairlane's generous 115.5-inch wheelbase, massive sound-proofing and total quality control and the impression of solid luxury is extraordinary.

But these highlights only hint at the advances 50,000 hours of laboratory study created for America's new kind of family car. You'll have to study it—and *drive* it—before you begin to know how astonishing the new Fairlane really is.



FORD

AIRLANE 500

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fine in my state, and we have some deep water. All marinas have rubbish cans.

M. G. COLLMAN, Watertown, Wis.

... BEER cans dumped on a spawning ground can ruin it for future use by our game fish. Any person throwing cans in the water would be unwanted here.

N. J. McCORMICK, Madison, Wis.

... IF THERE was room in the boat for full cans, there should be room to bring the empties ashore for disposal.

REUBEN TORGERSON, Tagus, N.D.

... THE Great South Bay is full of tin cans and if you dare to step off your boat, you risk blood poisoning.

RALPH KOAL, Brightwaters, N.Y.

... DUNKING cans is a water-contaminating way to dispose of garbage. It would be interesting to try dunking just one empty in the author's swimming pool

J. JENSEN, Des Plaines, Ill.

The Runaway on the Railroad

A FEW months after that ghost engine roared out of control on the Jersey Central tracks ["Runaway Engine on the Main Line!" Oct., p. 127], *Trains Magazine* ran an editorial on its wild adventures. The edi-

torial claimed that the Jersey Central termed the affair "as diabolical an act of deliberate vandalism as (JC)—or any other road—has witnessed in many a year."

WM. E. DICKERT, Chattanooga.

Surprise! Surprise!

WHAT does W. G. Waggoner ["Short Cuts and Tips," Oct., p. 169] have against the housewives of America?

He writes: "Sneak the sharpened opener back into the kitchen drawer and watch your wife's look of pleasant surprise" the next time she uses it. Pleasant surprise, indeed! She'll probably cut her hand wide open when she grabs the opener by the wrong end, not knowing that Mr. Fixit was there first.



IRENE VAN WALT, Milwaukee.

A Little Previous

YOUR October issue ["Detroit Report," p. 64] stated that it was a California law that all cars sold here must be equipped with

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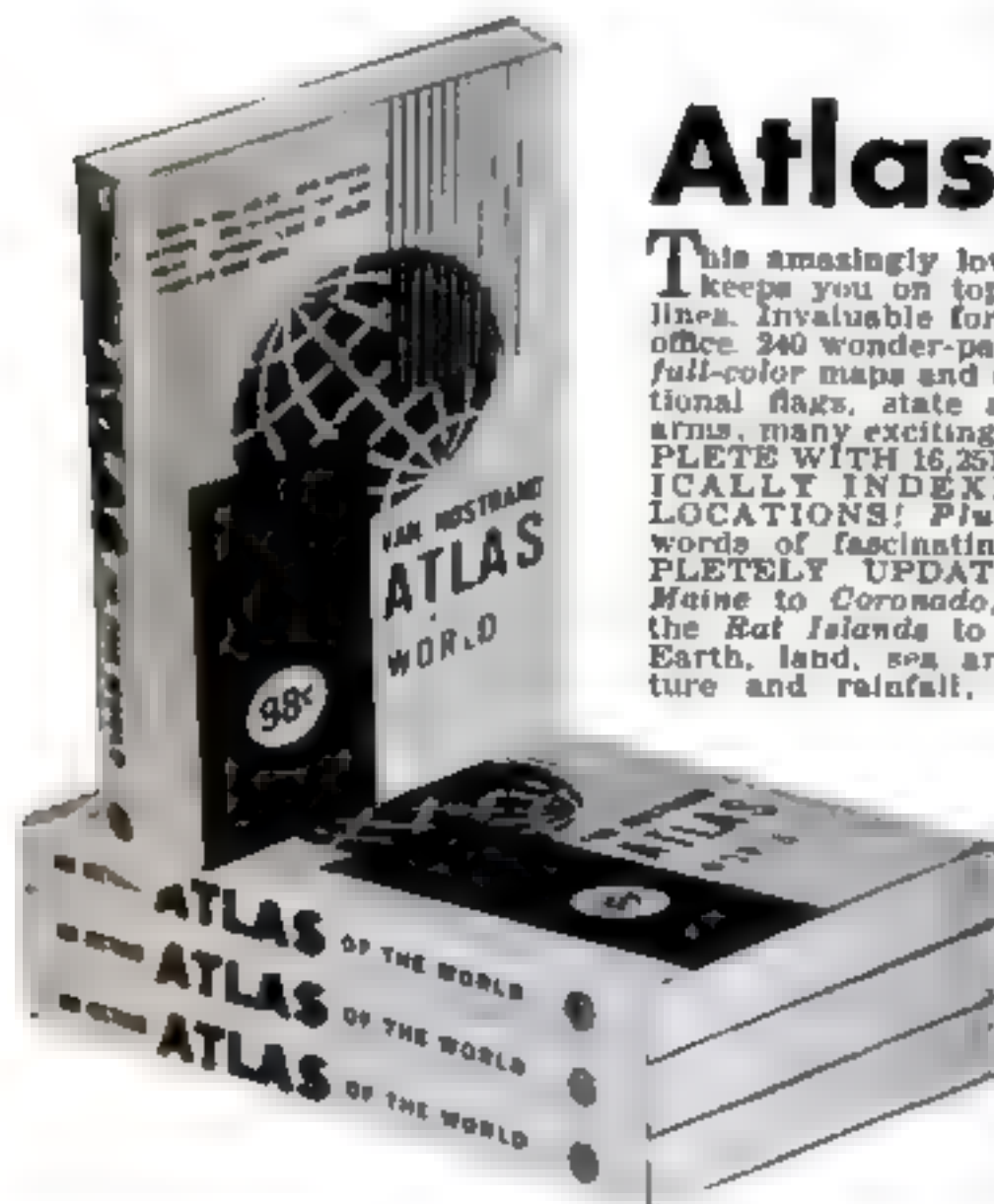
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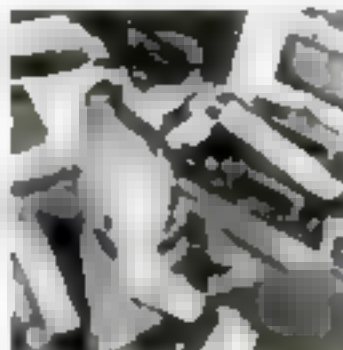


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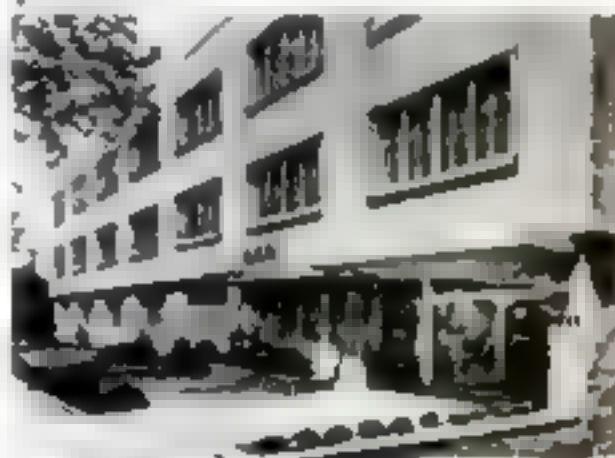


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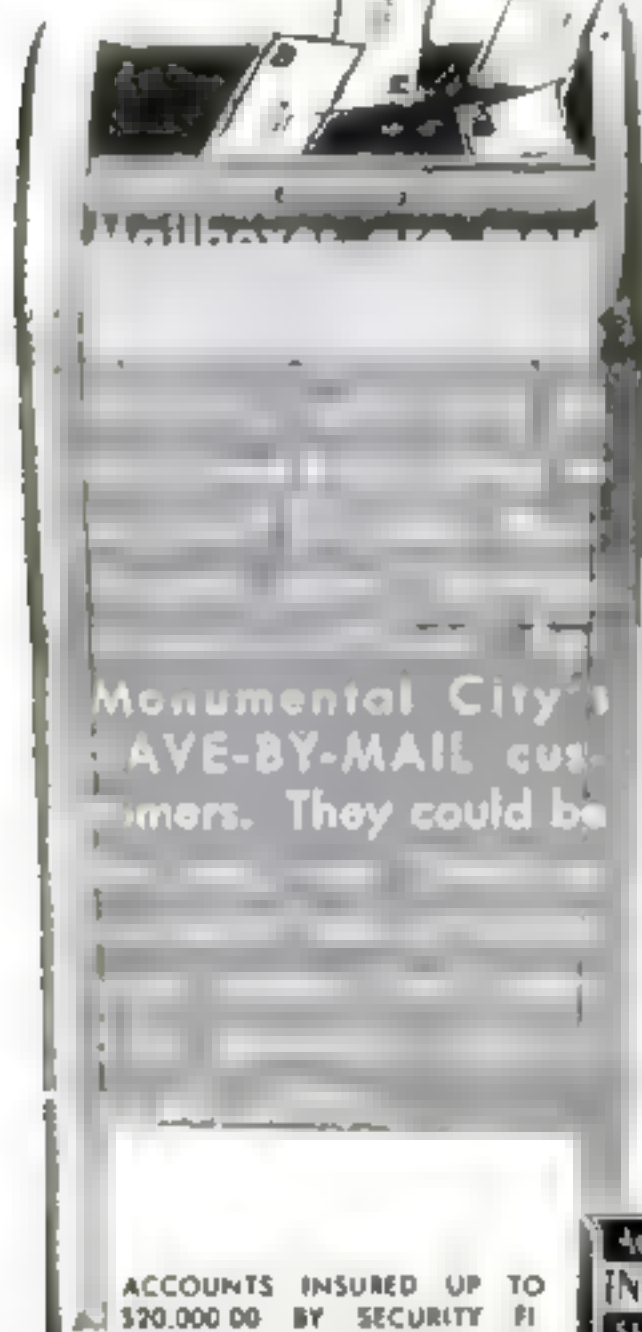
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smog eliminators. This is not true. The law states that at least two devices must be approved before it becomes mandatory, and to date only one (made by A. C. Spark Plug) has been approved.

LEONARD RUDGES, Davis, Calif.

Grab That Handle!

GET an electric shock every time you slide in or out of the car? I've solved that problem. I ground myself by firmly grasping a grounded part of the car (a door handle is perfect) before touching the seat, and grasping it again *before* sliding across the seat to leave the car. The method works well and is self-teaching. Each shock is a reminder.

M. D. ISELY, Inyokern, Calif.

Markovich the Hot-Rodder?

THIS month I've got to let off steam! Your Mr. Markovich ["What the '62s Are Like to Drive," Oct., p. 85] should be testing sports cars, since he expresses a preference for them. Perhaps a brisk bouncing in



his favorite kidney-pounder will jog him back to reality.

Take the Chevy II—"Lots of head room, leg room ample." Is he kidding? His five-foot-eight may shoehorn in there, but my six feet got coiled like a cobra. Not to mention the sun visor that lay on my eye like a gambler's shade. Then our friend admits, "It is undoubtedly one of the slowest-accelerating cars out of Detroit in years." The car is a pig, sure; but what did he expect from a four? And you can bet he was soft-throttling the mushy handling qualities.

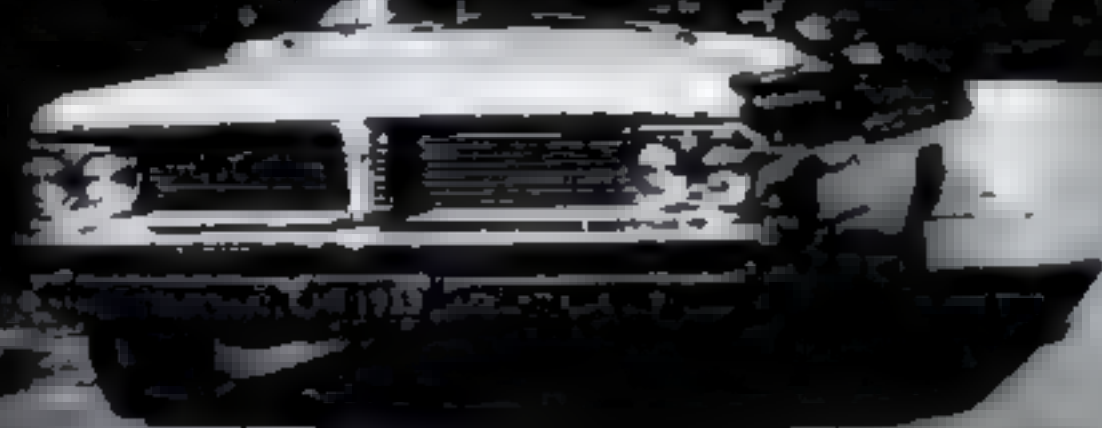
The big Chevy is notoriously deficient—lean and sway, understeer, slow response, etc., which he admits. If he felt like "king of the road" the road must have been very even and very straight, and he alone on it!

To Detroit, a dash of chrome slapped here or there and a smaller fin constitutes a major design breakthrough. The little VW scared the chrome off them. A used TR-3 will run circles around them. And dollar for buck, the VW is still a smarter buy. Me? I'm saving for a Mercedes-Benz.

EDWARD BECKER, Brooklyn, N.Y.

... SOMEBODY should bring Markovich the word. Most of your readers are do-it-yourselfers trying to get enough of the elu-

CONTINUED



Catalina: Stormer out of Pontiac

This one comes on with a rush — a new breed of "Cat" from Pontiac. Touch toe to throttle and watch that Trophy V-8 gobble up road. Arc the wheel and feel Pontiac's Wide-Track unbend the curves. Driving a Catalina is a real kick. No question about it. And a good-sized chunk of the fun comes from the things you choose yourself. Engine power: it ranges from a thrifty 215 h.p. rig to the 348 h.p. Tri-Power screamer. Transmission: standard three-speed manual. Optional at extra cost: four-speed, floor mounted stick or Hydra-Matic. You can tailor this baby to your tastes all the way back to the rear axle ratio. And you'll like the basic package, too. The Catalina is slightly longer this year. (Wheelbase has gone up to 120".) The turning circle is tighter for sharper maneuvering. You'll go for its looks, light handling and lightning action. Check with your Pontiac dealer. He's a man after your own heart. And make it soon! Pontiac Motor Division — General Motors Corporation.



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sive bucks to keep the wife and kids properly with a little left over for Pop.

We are not hot-rodders or sports-car enthusiasts, and are little interested in super-models with bucket seats, consoles, and 10-second engines. We buy the standard model and want to know about brakes, visibility, economy, and soundness both as to investment and construction. In a word: Is the car all right for the wife to take the kids to the beach or school, and for me to take them over the turnpike to Grandma's on weekends?

R. D. BATES, Miami.

... You say the Ford's emergency brake "is a definite improvement, Step-on type." Obviously Mr. Markovich hasn't driven Fords for the past few years. Since 1959 Ford has been using a step-on brake.

CHARLES LEDERHOUSE, Bronx, NYC.

Markovich says he was referring to Ford's brake as an improvement over the handle-type unit of the Falcon and the other makes previously mentioned, and not as an improvement over the 1961 Ford's brake.

Different But Better?

ONE of the "I'd like to see them make" contributors [Oct., p. 104] wants a pistol-grip propane torch so long jobs would be easier on your hand. I don't know of any just like the drawing, but the Bernz people do make a torch with a handle grip on the end of a hose. The four-foot hose permits overhead work without weight.



LEE WALDRIP, Charlotte, N.C.

He'll Write His Own Dictionary

IN THE October "Materials File" tear-out ["The Types and Grades of Calking Compound," p. 143] the writer mentions that some manufacturers prefer to spell calking with a useless "u." Thus he goes along with Webster's first preference. But if I'm going to drop a letter out of the word, it will be the "i" which is as silent as the p in psycho.

F. S. WETHERELL, M.D., Largo, Fla.

Now you're talking.

Oh Come, It's Easy

I CAN'T for the life of me see how you can drag a tin can on a chain along a gutter ["Short Cuts and Tips," Oct., p. 182] to

CONTINUED



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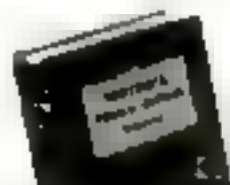
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clean it. Half-round gutter is hung with wire hangers every few feet; box gutter is hung in many ways, all obstructive. According to the sketch, Clarence Winchell must have his pasted on with chewing gum.

ANTHONY MILDICE, Binghamton, N. Y.

His gutters, obviously, are supported by brackets underneath instead of overhead hangers.

Help for Smeared Windshields

THE solution to the problem of the man with the smearing windshield wipers ["PS Readers Talk Back," Sept., p. 19] is a solution: three ounces of ammonia to a quart of hot water.

Use this to wash windshield and wipers. Then rinse with a half-and-half mixture of vinegar and water and wipe dry with



paper towels, or even newspaper, instead of cloth. It's soap or detergent that causes smearing. Either one leaves a film on glass that is almost impossible to wipe off.

N. GRAVES, Portland, Ind.

... THAT smear that Phil Garand talks about may be due to the weather. A lot of hot and dry weather takes the life out of the wiper blades. Solution: Buy new blades and if the weather is such that the hot sun dries them out, remove them when not needed.

JACK STEIN, San Pedro, Calif.

... I GOT tired of trying to look through that mess on the windshield, too. When new wipers didn't help, I tried my old reliable: ½ vinegar and ½ ammonia plus some hard scrubbing, and don't forget to do the wipers.

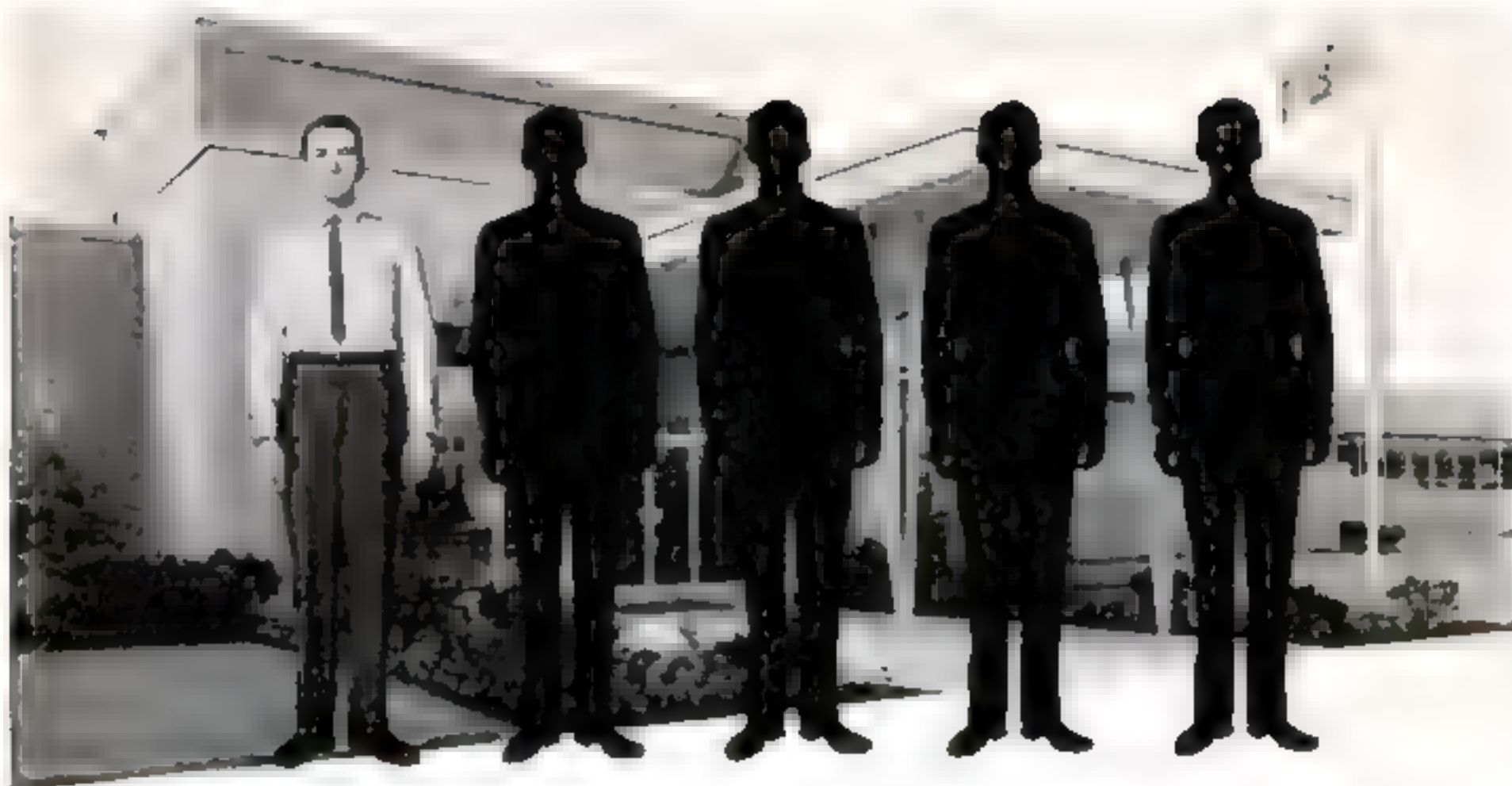
If that doesn't help, check the wiper-arm spring. Even on some new cars, the spring isn't tight enough to do the job. As for the cause, I think it's the dirty rags some gas-station attendants use.

MRS. JOHN C. AFFELDT, St. Paul.

... I'VE found that a bag of Bull Durham smoking tobacco (about five cents or so), soaking wet, rubbed over the windshield briskly will put an end to smears.

R. H. GUTRIDGE, San Diego.

... I SOLVED the problem with Flash—a liquid compound in a plastic squirt bottle. You can add it to the contents of a windshield-washer tank or (when it's raining)



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squirt it directly on the windshield with the wipers operating

E. J. CONSTANT, Topeka.

... I USE Boraxo poured into a small salt shaker. Shake a little on the wet windshield and rub with your hand or a towel until the glass looks clear.

MILFORD CROFF, Morley, Mich.

... THAT smearing is caused chiefly by grease and oil washed from the underside of the car. Keeping a good distance behind other cars when the road is wet helps. For years I've been using Ajax to remove the film.

NORMAN W. NELSON, Alberni, B.C.

... CREAM of tartar is the ticket. Sprinkle on area of wiper-blade arcs and rub with tissue or cloth. Also clean the blade's edge. I'm a professional driver and I've often wondered how I got along before using my old reliable.

PAUL J. PUCKETT, Denver.

... I GET results by using plain old newspaper. Wet a page and clean the windshield (it removes bugs easily, too). Finish with a dry piece of the paper

JAMES KLINGLER, Summit Hill, Pa.

... CLEAN your windshield with Bon Ami and then ask the guy at the filling station to use only clean water and a clean paper towel and remind him each time. Otherwise he'll use the same towel or rag that he uses when checking your oil.

J. W. HATCHER, Tallahassee, Fla.

... Pour a coke down the outside of the windshield with the wipers going as slow as possible and it will remove the film from the glass. I only pour on the coke when I'm going to be driving in the rain, so the residue will be washed off

WILSON DARDEN, Memphis.

S.O.S. from a Southpaw

A NUMBER of items made especially for southpaws are mentioned in "It's a Clumsy World for Lefty" [Sept., p. 103]. I wonder if anyone knows of a corkscrew made for left-handed people? I'd like one

W. A. WAYMOUTH, San Juan, P. R.



His Idea's All Wet

I HAVE news for A. E. Brochon, one of the winners of your prize-winning home ideas. He's the fellow who stretched a soil soaker

CONTINUED

new home-import business...

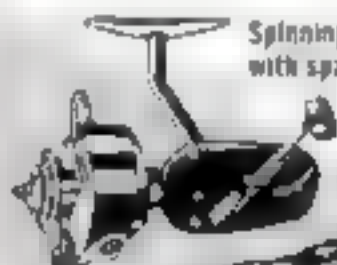
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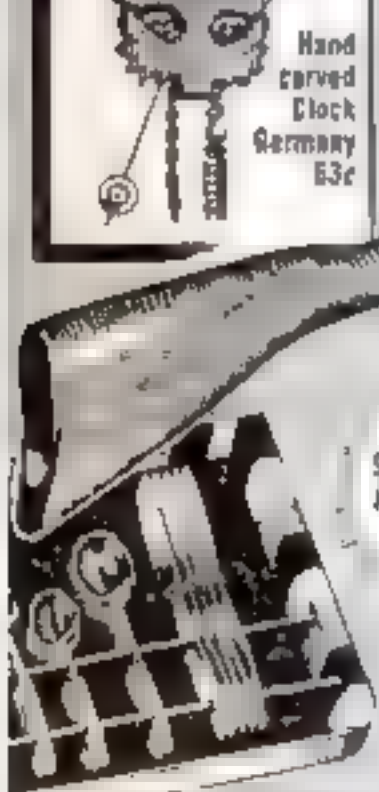
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over the roof [Sept., p. 188] to cool things off. If he has an asphalt roof and it's sprayed with water when the shingles are hot, the granules will be washed off and all



that will be left where the water hits with any force at all will be some soggy backing.

Believe me, I found this out the hard way after two years. After replacing the hip and ridge shingles, I installed an attic fan. Water cooling can ruin a roof unless it's kept flooded day and night all summer.

C. F. ROSENER, Reseda, Calif.

Bonus: One Free Key

IN A last year's Detroit Report [May, p. 42], you told about a Rambler buyer who found that the ignition key of his new car fit the lock of his 1941-built house. You called it "the year's weirdest coincidence."

I can match it this year. I've bought a new Rambler American and the glove-compartment key of the '53 Dodge I traded in fits my new car's ignition.

WM. GLASER, Hopedale, Ill.

A Great Plane—A Great Pilot

WITH much delight I've just finished reading "Remember the B-36?" [Sept., p. 98]. But it was not necessary, as you say, for a crew member to climb out into the wing and observe the locking of the main landing gear from the wheel well. From the lower-aft scanner's or gunner's position, a device on the main strut told the gunner if the gear was down and locked without his ever having to leave his position.

Also, you made mention of the B-36 having made a perfect landing with three engines out on the same side. This landing, or one similar, was made at Carswell AFB, Fort Worth, on March 26, 1954, with all engines including the jets out on the left side, no flaps, and a malfunction in the landing gear. As a member of that crew all I have is praise for the ship and its two great pilots—Capt. Berry H. Young, pilot, and Lt. Roland J. Reidy, copilot.

JOHN H. AKERS, Hurst, Tex.

Match Book Is Old Stuff

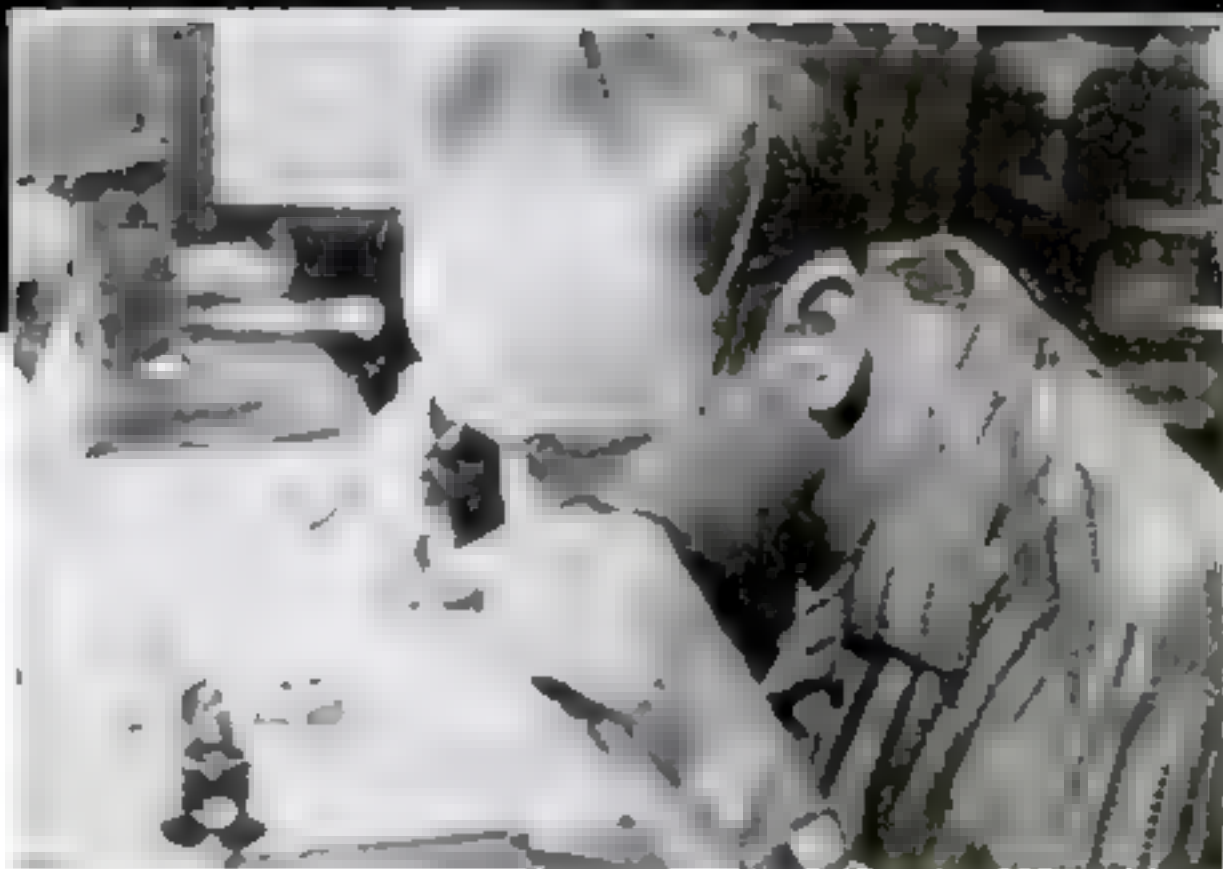
ONE of your readers would like book matches with adhesive on the back ["I'd Like to See Them Make," Sept., p. 85]. We've been using such matches as part of our advertising for some time. I believe

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the patents are held by the Piggy Back Match Co., although the Lion Match Co. makes them for us. There are just 20 matches to take care of the 20 cigarettes in a pack.

As I recall, some of these book matches reading "Stick with Ike" were used in the 1956 Presidential campaign.

WELDON L. PORTER
Welex, Houston, Tex.

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CHARLES G. MUENDLEIN
Maryland Match Co., Baltimore.

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DR. GEORGE WYKOSKI
Oak Forest Drug, Little Rock.

Under the Hood

THE Buick V-6 connecting rods won't stand up well if offset as in your drawing showing how the odd-ball six works [Oct., p. 76]. Each bank of cylinders could be offset half the con-bearing width, leaving the rods straight. Wrist pins in the illustration are not shown correctly.

There should be no objection to the uneven firing of this 90-degree V-6. My two-cylinder John Deere tractor fires at intervals of 1/2 and 1 1/2 revolutions and is smooth at working speeds.

RALPH L. KUNAU, Sabula, Iowa.

... YOU say [Oct., p. 74] that the 1928 Chevrolet four, with a bore of 3.688 in. and stroke of 4 in., had a displacement of 194 cu. in. I get a displacement of 170 cu. in..

$$= \left(\frac{3.688}{2} \right)^2 \times 4 \times 4 = 170.$$

DUANE L. HICKS, Ft. Worth, Tex.

That's egg on our chin.

Kelly Came First

THE author of "Why Inventing Is Still a One-Man Job" [Sept., p. 70] claims that the first significant breakthrough in the making of steel was by Bessemer. This is not so.

Bessemer was granted a patent on the process in 1855, but William Kelly, an ironmaster from Kentucky, proved in 1857 that he had used the idea as early as 1847. As a result, Kelly was granted a priority patent. Bessemer and Kelly merged interests in 1866, and the process since has been known

as the Bessemer conversion process for steel making.

N. J. GOULD, Cleveland.

Pick 'Em Up and LAY 'Em Down

THAT reader who "would like to see them make" [Oct., p. 104] a sleeve-like apple picker would be very unhappy if they made him one and he used it. The apples falling down the canvas chute would become so bruised as to be unsalable. No professional apple-picker, out here at least, ever wears a bag at the side. It's always in front so every apple can be laid down gently.

CHAS. C. FINN, Seattle.

... I MADE a bag similar to that Mr. Bursdak wants and was fired after using it because of bruised fruit. So many ideas sound good but won't work out! This is one of them. Bruises mean culls. All pickers must have close-trimmed fingernails and must put down the fruit gently.

GEORGE E. MINER, Chicago.

Tip from a Banker

MANY stateside bankers surely rejoice with me that R. Ramnath ["PS Readers Talk Back," Sept., p. 10] is in Bombay, India. His check-raising protection—covering the written-out amounts and figures with

Scotch tape—is a sure jammer in a bank's check-canceling machine. Equally objectionable to us is the habit of pasting coins together with the same material. Cellophane tape is wonderful—but not where it has to go through a machine or be taken apart.

PAUL R. MCCLURE, Cashier
Port Royal National Bank
Port Royal, Pa.

Too Many Wheels

THAT eight-wheeled car of Enoch Johnson's ["PS Picture News," Sept., p. 102] was interesting. Fifty years ago, a car called the Octoauto was made by the M. O. Reeves Co., Columbus, Ohio. The suspension was patterned after the Pullman Palace-Car and it was advertised as "the only easy-riding car in the world" and "the easiest car in the world on tires."

Reeves also built the Sextoauto in 1912. This car had the four-wheel arrangement only in the rear.

LT. H. P. JOHNSON JR.,
Mountain Home AFB, Idaho.

Matches with Taste

READERS with very young children might like to try this "experiment" with them.

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[Continued on page 37]

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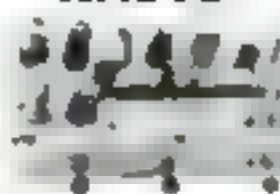
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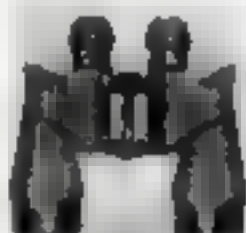


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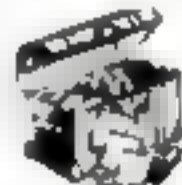
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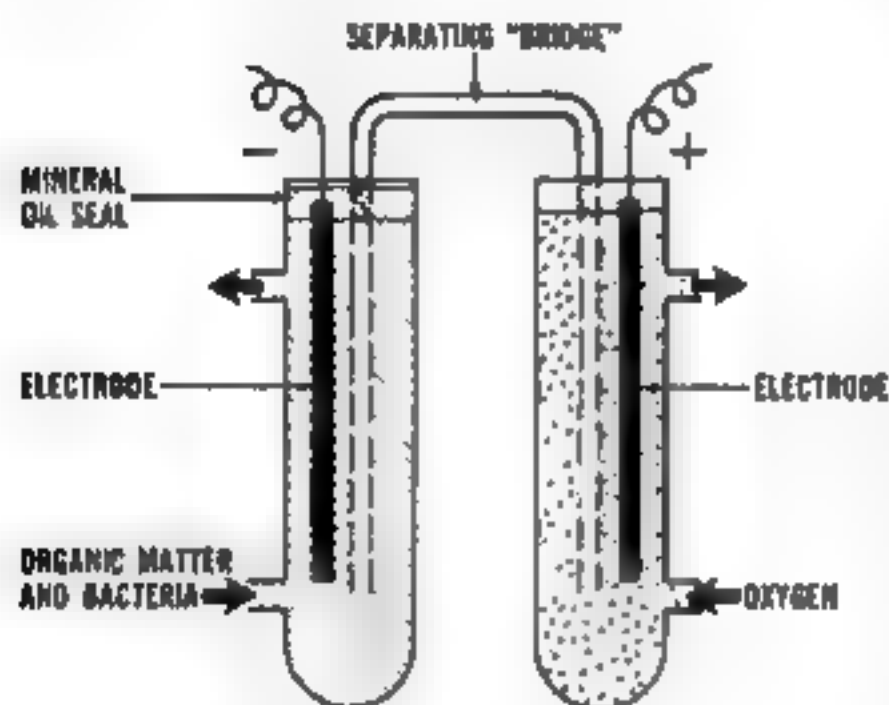
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The march of science

Electricity from the septic tank. What seems like an absolutely ideal source of electric power—for homes, electric cars, silent submarines—is now coming out of the laboratories. It is a battery that uses bacteria or enzymes (chemical-reaction speeder-uppers) to decompose organic material and release electricity. The organic material can be almost anything: sawdust, ground corn-cobs, lawn clippings, sewage, or stuff in sea water.

First mention of a successful "bio battery" came last spring from Dr. Frederick D. Sisler of the U.S. Geological Survey, who got a faint trickle of electricity from test tubes containing bacteria, organic matter, and sea water (below). Now it turns out that the Navy has had Dr. Gilson H. Rohrback of Magna Laboratories, Santa Fe Springs, Calif., secretly working along the same lines. And Magna's bio battery produces a million times more elec-

tricity—not yet nearly enough to drive a car or submarine, of course, but sufficient for radio beacons and signal lights. It is about to be tested at sea.



Bio battery developed by Dr. F. D. Sisler.

The bio battery uses the same basic process that goes on all the time in septic tanks, compost heaps, the oceans, and everywhere else. Bacterial enzymes force hydrogen (present in all organic materials) to combine with oxygen (from air or dissolved chemicals) and form water. The enzymes, in effect, pull electrons off hydrogen atoms and give the electrons to oxygen atoms. This is a sort of flameless burning, and it releases heat, not electricity. To

make this burning process work in a battery, it must be slowed down and separated into stages. The trick is to keep the electrons that the hydrogen lets loose from getting to the oxygen until they first go out the battery cathode, run through the wire circuit, and come back into the battery at the anode. That way you get an electric current through the wires—electrons are the tiny particles that make up electricity.

Magna's bio battery is as big as an auto battery. One electrode is metal that will be gradually consumed by the electricity-generating action. The other electrode contains bacteria which work on sulfate chemicals in sea water. The sea water also serves as the electrolyte. How powerful is the unit? Best guess: five watts.

Russian fallout shelters—is they or is they ain't? Persuasive sales point for American civil defense has been: The Russians are already doing it; therefore we should hurry and catch up. The man who pushes this idea hardest—in articles, interviews, and testimony to congressional committees—is Leon Gouré, So-

The march of science continued

viet specialist at the Air Force's think factory, Rand Corp. Gouré says that the Russians have been "engaged in a serious, energetic civil-defense program" for many years. From official Soviet reports and manuals, he culled these details:

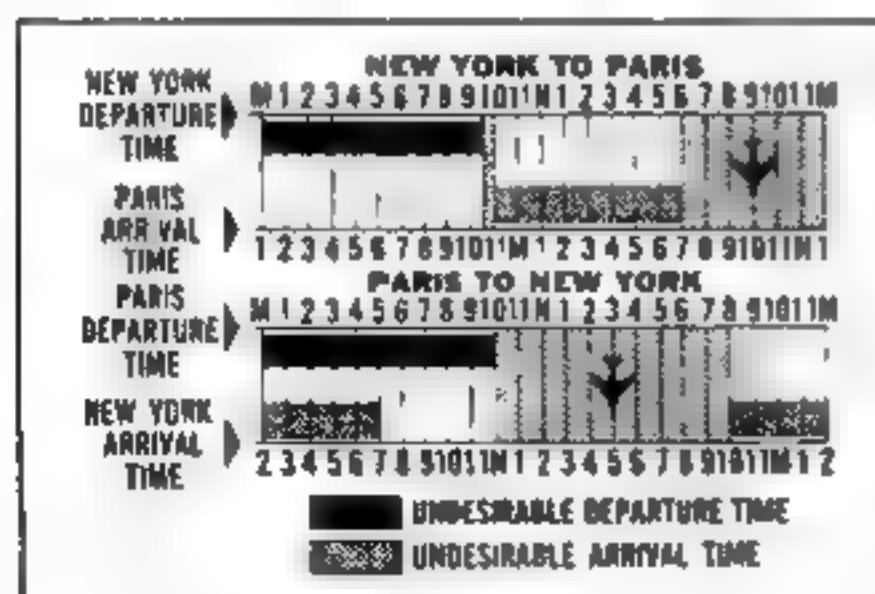
- Three civil-defense training programs—attendance compulsory for all adults—have been conducted since 1955.
- Specific designs for a wide variety of shelters are worked out.
- Detailed plans prescribe large-scale evacuation and rescue operations.

Does this extensive preparation exist in reality—or only on paper? Gouré admits, "There is little information available on actual construction of shelters by the Russians . . ." Some skeptics suspect his sources may be misleading. After all, a stranger in the U.S. might easily be snowed by the "Shelter" signs on our streets, the torrent of handouts from civil-defense headquarters, the confident speeches of politicians—and fail to see how dangerously vulnerable we really are. It would be even simpler for us to make that kind of mistake about the Russians.

Further doubt was raised last fall by—of all people—the wife of Soviet Premier Khrushchev. Speaking to a group of American "peace marchers," she said that the USSR had made no preparations for civilian shelter.

Yet it is hard to believe that the Russians could foolishly neglect to protect their own population against attack that they obviously fear. They never pinch pennies on defense of their homeland. And it would be still more foolish for us to neglect our own protection, no matter what the Russians have or have not done.

Why you can't fly overnight from Paris to New York. American tourists take off by jet from home in the evening and land in Europe the next morning—a happy arrangement that gives you plenty of time to check into your hotel and even lay on a little sightseeing that first day. Coming home, though, it won't work that way. You have to leave during the day.



The reason is not high-handed arbitrariness on the part of airline timetable writers, but human nature complicated by jet speeds and 3,000 miles of time difference. Paris to New York consumes eight hours of time, yet, because of time changes, bridges only two hours by local clocks. If you left Paris at 11 p.m., you'd land at Idlewild around 1 a.m., when not even your best friend would come to meet you. Eastward trips give an even bigger headache to

schedule planners. To avoid middle-of-the-night departures or arrivals, they must cram nearly all Europe-bound flights into about six evening hours.

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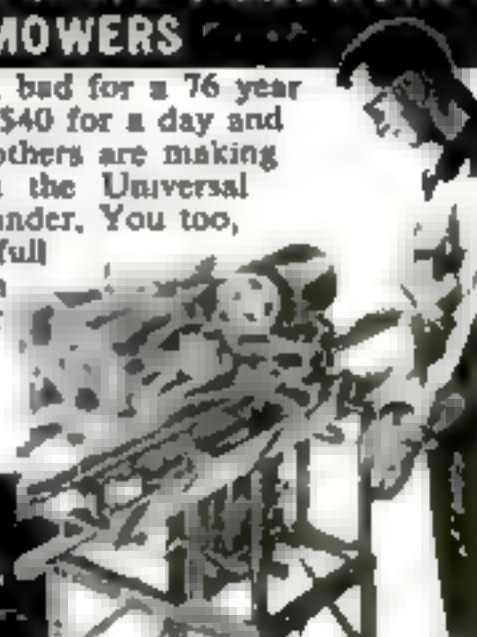
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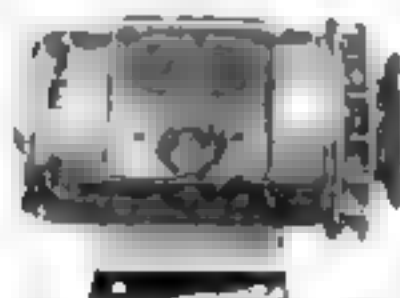
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[Continued from page 26]

water. Drop eight or ten burnt matches on the water surface and arrange them like the spokes of a wheel, with the unburnt ends forming a hub. Now hold a piece of soap in the water at the hub. Soon the matches will float away from the soap toward the outside of the pan. Next, hold a sugar cube in the water at the same center point. The matches will float back to their original design.

I have no scientific explanation. Can any other reader tell me what's going on?

R. L. WESTON, East Orange.

Burning Holes in Glass

Now and then, I've noticed letters on making holes in glass. For 44 years I worked with glass in all shapes and forms. To make a hole, I do this:

Find a pencil or dowel the size of the hole you want and build up a fire-clay dam around it. Make a well on the underside of the glass, too; or you can lay the works on a sheet of asbestos with a hole the desired size cut in it. Heat lead hot enough to burn a pine stick black. Using a heated cast-iron ladle, pour the hot lead into the well hole and presto! you have a hole in the glass.

When burning a hole in a bottle, put enough sand in it to catch the molten lead and keep it from burning other places.

W. J. BODA, Hartman, Ark

He's For the 'Birds

I AM glad to note that Dodge's Polara is "frankly fashioned" to compete with Ford's Thunderbird ["What's New in Engineering Oct., p. 78]. I wondered what the chrome gewgaws on the rear fenders were for.

Since 1960, the Chrysler Corp. has practically eliminated itself as a competitor and if they don't improve their body styling they'll find themselves in fourth or fifth place. Alternators, axial-flow blowers, and no-whine starters are fine, but it's an eye-catching body style that sells automobiles.

The industry's various modifications of the T-bird roof line are interesting. To have Cadillac as well as B-O-P, Imperial, and Studebaker copy a design, or rather imitate it, is the height of flattery.

R. C. McBRIDE, Los Angeles.

Setting an Old-Timer Right

I'M 13 and I'd like to tell Mr. Claussen ["PS Readers Talk Back," Nov., p. 22], the bike-riding old-timer, that he's wrong when he says that toe clips, or traps as they're called now, are "unknown today." On almost all "derailer" (French) bikes, the pedals are equipped with traps. With the right pedals, you can have them on any bike.

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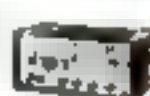
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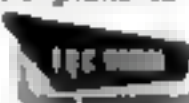


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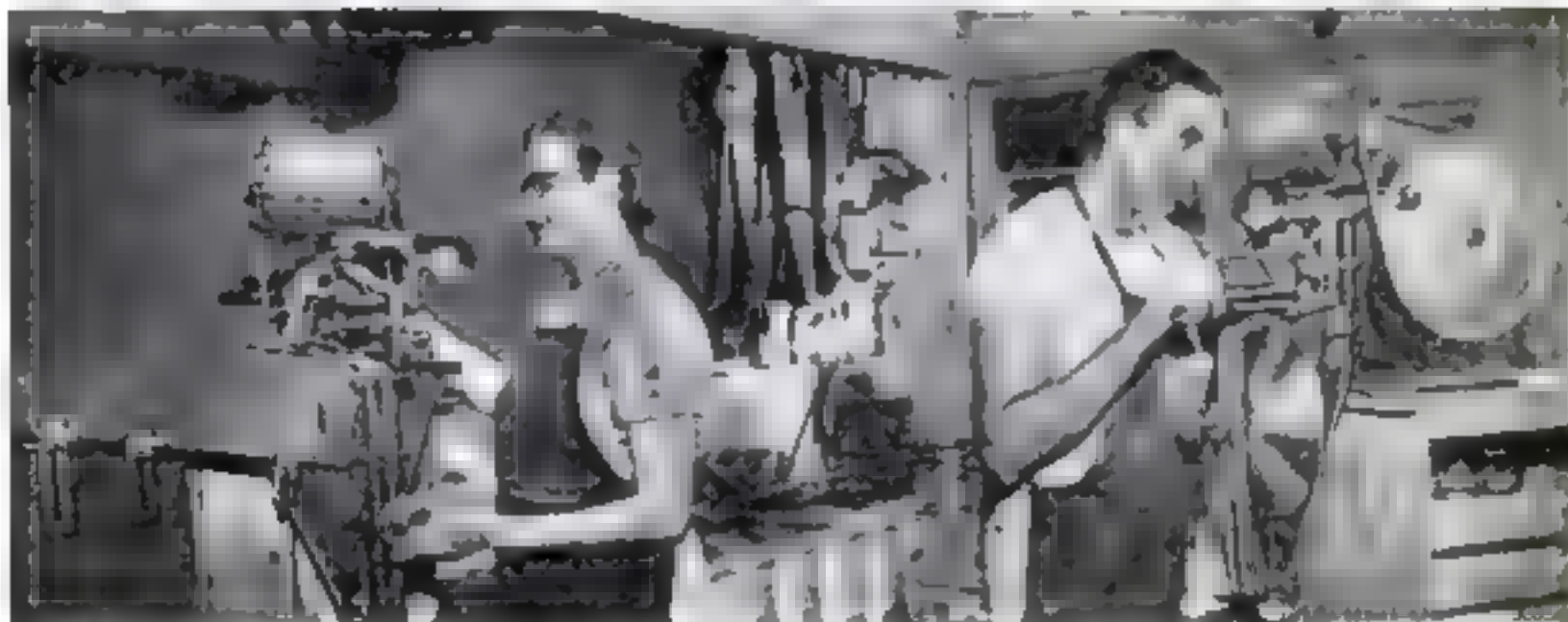
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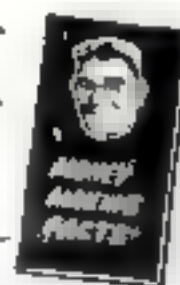
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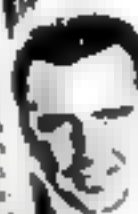
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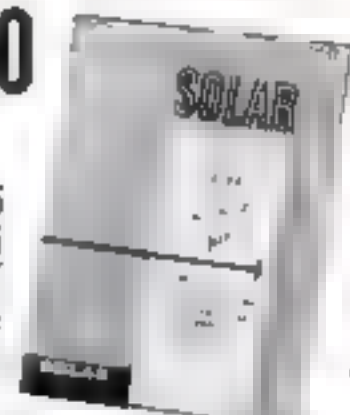
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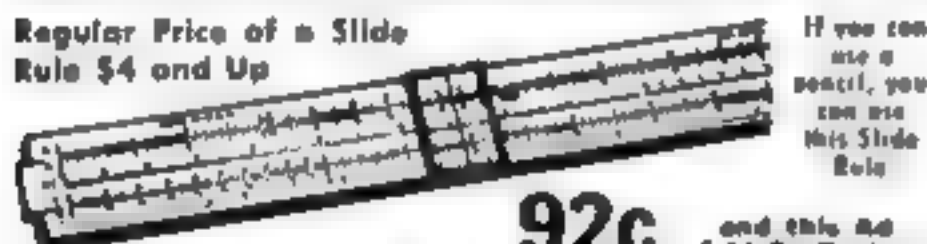
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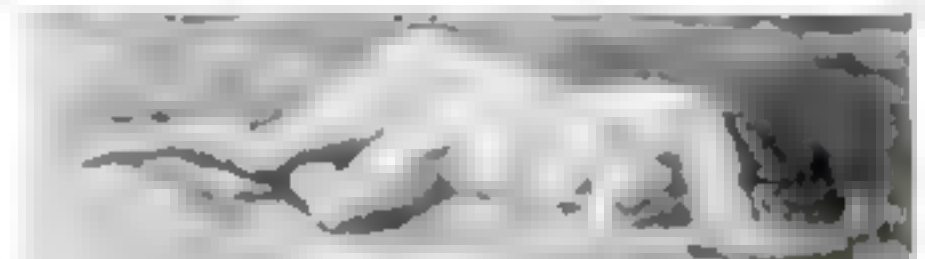
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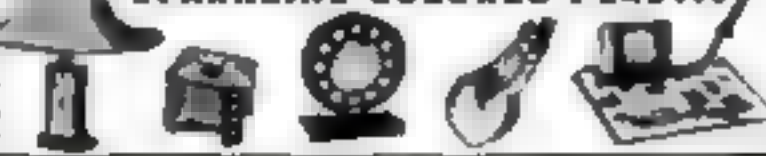
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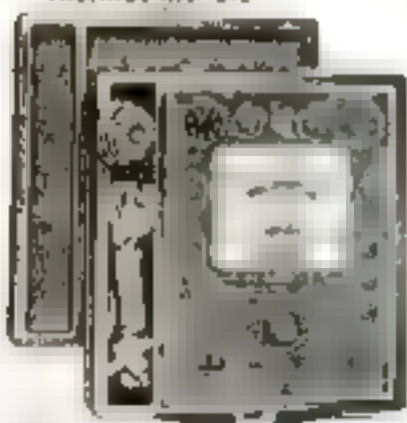
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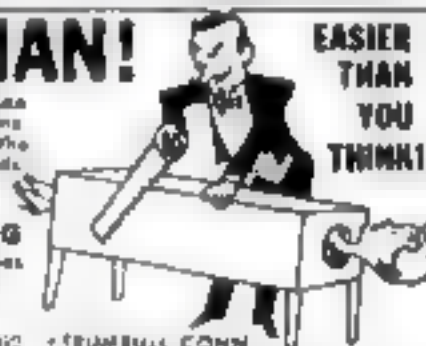
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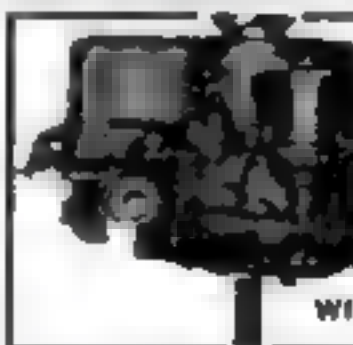


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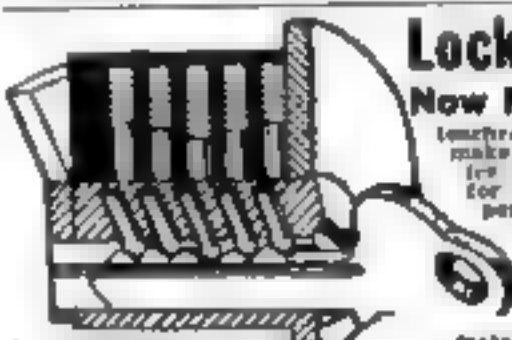


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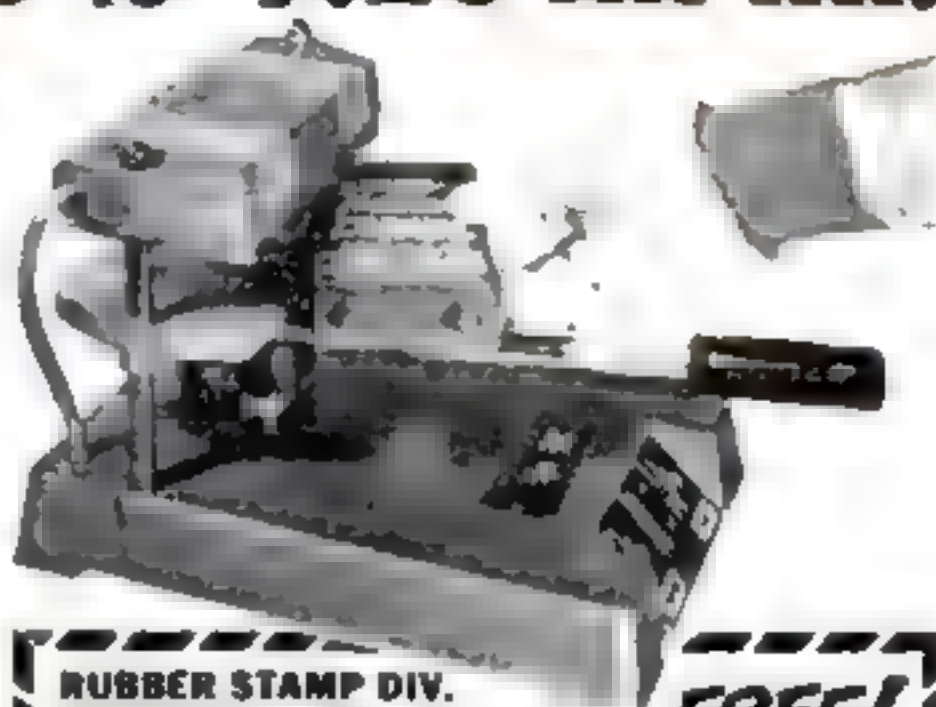
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DETROIT REPORT

By Devon Francis

Hydrogen Power for Autos?

GENERAL MOTORS has a small but intensive program under way aimed at the development of a fuel cell that will drive an automobile. And what's a fuel cell? Essentially, only an electric battery. But this one produces electricity from

a chemical that is piped into it instead of being stored in it. A constant flow of current issues from the cell to drive an electric motor. The chemical—fuel—can be any one of such things as hydrogen, gasoline, alcohol, or propane gas. A catalyst in the fuel cell makes the chemical combine with oxygen, also piped in, to produce the current.

Some two dozen electrochemists and engineers at the GM Research Labs, the Delco-Remy division, and Allison division are conducting three separate fuel cell programs. Opinion as to whether the idea is practical is divided. But hope is high—80 other U. S. firms, including Ford Motor, are involved in fuel-cell research.

Wups! More horsepower again. Oldsmobile this month will unveil details of that engine supercharger it announced late last summer. And Pontiac and Chevrolet may not be far behind. Pontiac's blown engine has been under development for five years. To provide the excess air, it uses heat energy from the exhaust. Chief advantages of the blown engine: improved acceleration at speeds above

45 miles an hour and better gas economy.

One big problem with blown engines is the extra heat they develop. Compress air, and you get heat. That's added to the heat of combustion. It's hard on valves. One solution may be salt-filled valve stems. The salt melts at a certain temperature, acting as a heat-absorbent and conductor to drain temperatures from the valves into the engine block.

Lean gas. To reduce fuel consumption on future cars, both Ford and GM may put a cylinder's air-gas charge on a Metrecal diet. It is called a gas-stratification system, and works the way a soda jerk builds a vanilla-raspberry sundae. A rich but thin layer of air-fuel vapor is shot into the top of the combustion

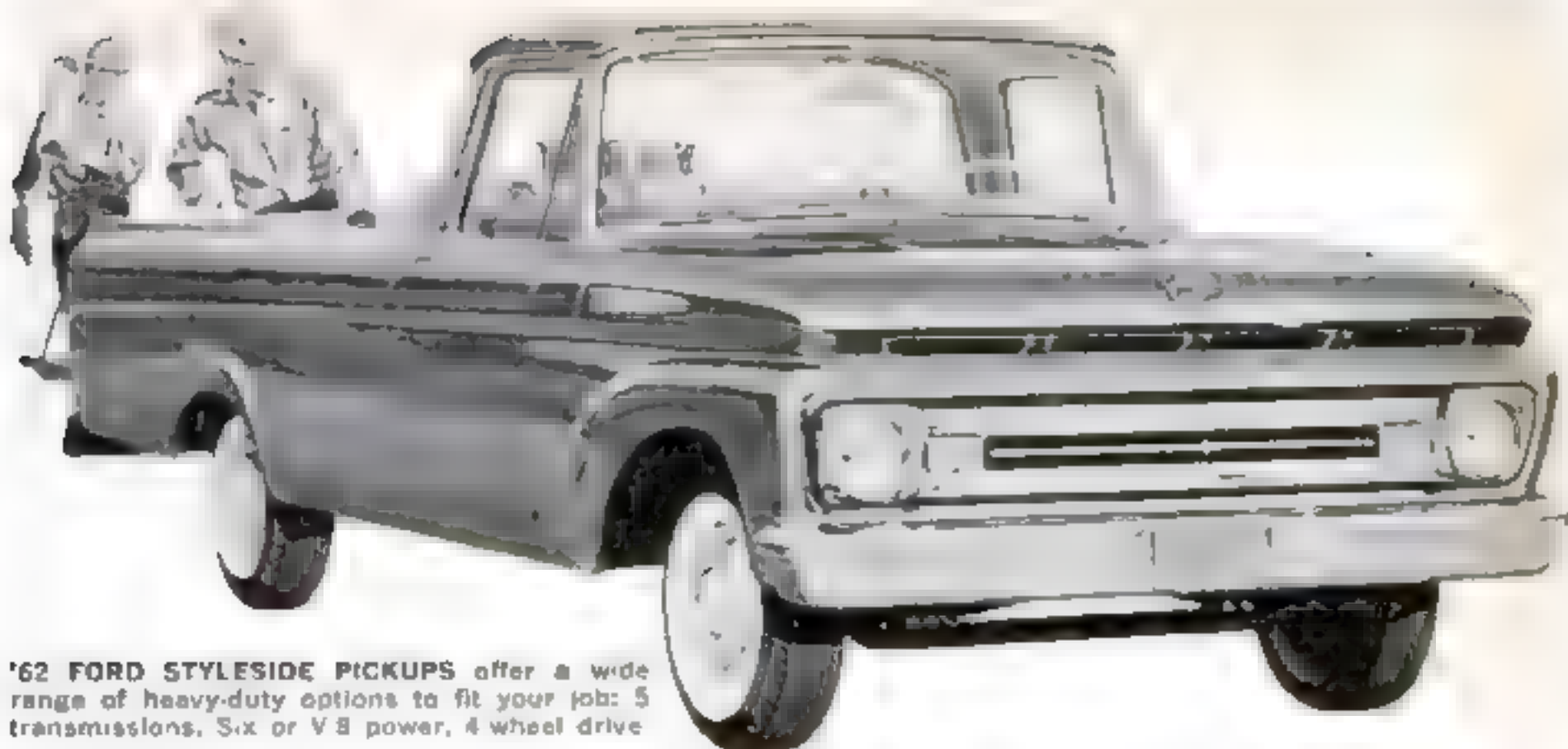
chamber, a thicker layer of lean vapor into the bottom. The bottom layer burns handily when the top layer is ignited. Fuel economy is improved. A question yet to be answered: Since it takes a pretty good fuel-air mixture to cool a cylinder head, what happens to engine temperatures with stratification?

V-6 flirtation. Now that Buick has broken the ice with America's first V-6 engine, will other car makers follow? The V-6 has its merits: It's more compact than a straight six, smoother than a four-cylinder engine.

Rambler has under study an aluminum V-6 developed by Doehler-Jarvis, the same company that produces its in-line aluminum six. Rambler's V-6 of aluminum would be die-cast. Buick's V-6 is made of cast iron.

Oil filters and baked beans. Been wondering what filling stations are going to do when the lubricated-for-life automobile becomes common? Well, so have the filling stations and oil companies. Looking forward, the oil companies have

a program under way to give proprietors of the nation's 200,000 filling stations things to sell besides gas and oil—household products and maybe even food. The program isn't due for inauguration for a couple of years more.



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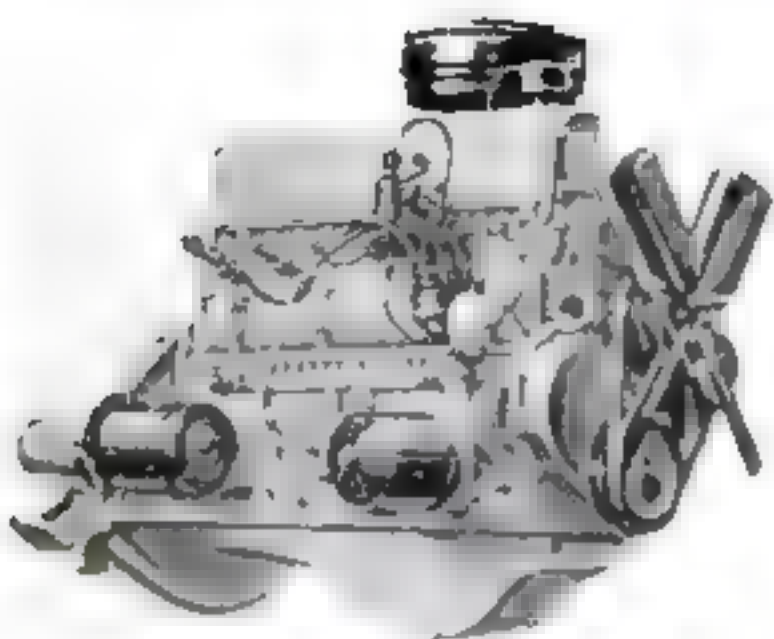
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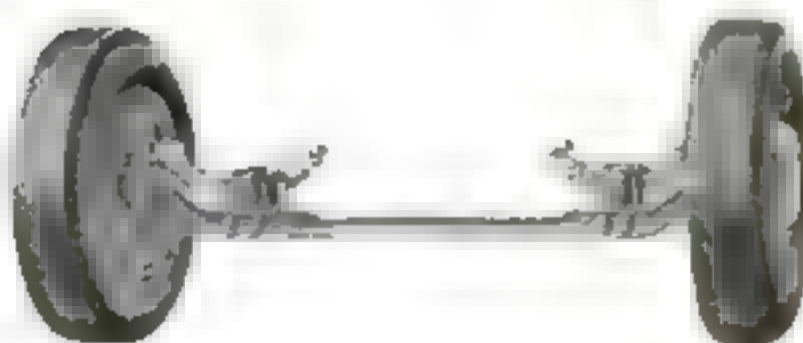


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PRODUCTS OF  MOTOR COMPANY



TIRE-SAVING FRONT SUSPENSION, Ford's truck-type suspension keeps tires tracking true. Delivers far longer tire life than trucks with other type suspensions.

EARN \$10,000 A YEAR

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The average starting salary of students, completing our FCC License, Electronics Technician Courses, and those completing our Diesel Automotive Training, is \$4,300 per year.

After becoming familiar with the industry, their salary usually increases to \$6,000 or \$7,000 per year.

After they become senior technicians, or master mechanics, they can earn \$8,000 to \$10,000 per year.

When they become specialists, or a part of management . . . or start their own business . . . they can earn considerably more.

RESIDENT SHOP TRAINING is easier and costs less than you may think! We provide you with housing and part-time jobs while in school, plus free nation wide placement service for graduates.

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Earn \$5 per hour in your own

LAWN MOWER SHARPENING SERVICE



Earn extra money right from the start—average \$5.00 per hour. Full or spare time opportunity. The Modern Lawn Mower Sharpener is a complete shop in one machine. You don't need experience to start—anyone can operate it, and turn out perfect jobs. All operations are done quickly, easily and accurately. Write for full money making details.

FOLEY MFG. COMPANY

194-2 Foley Bldg., Minneapolis 10, Minn.

OIL LEASES

Many now enjoy "Second Incomes" from Oil Leases up to \$100.00 per day plus Big Bonus payments. Let me tell you how you can be an Oil Lease owner that may mean financial security to you.

CHAS. W. CRADER, P. O. Box 887-PS
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FALSE TEETH

New Plate Made From Your Old—
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SEND FOR FREE INFORMATION on new professional method that gives you light, comfortable natural looking perfect-fitting plate—upper or lower. From your old worn, broken, loose plate without an impression. With guaranteed **SEND NO MONEY** just send name address and such data as you want. All your old plates are used. **TRU-SMIP DENTAL LAB., 137 N. Dearborn, Dept. 174, Chicago 2**

GIANT KNIFE

SHARP, RUGGED, IMPORTED BEAUTY
A GIANT—WORLD OVER FOR ITS
EASE, SAFETY IN USE, LIFE & DEATH
SAFETY. IN THE HAND. Made of
fine stainless steel, guaranteed to stay
sharp and open every time.
Set a new standard for
the most useful knife
in the world. It's the
GIANT.



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A number of one-man mail order enterprises are paying their owners an income of \$40,000 to \$50,000.

SPECIAL OPPORTUNITIES



Mail order is big business. Annual catalog sales volume of Sears, Roebuck and Co. is over 700 million dollars!

HOW TO START

Your Own Mail Order Business

You can make a fortune by mail. New firms will set you up in a fabulous mail order business of your own! They'll make up your catalogs, prepare your advertising, supply mailing lists and even ship your products for you!

By Robert Stephenson

When Anthony Sambati injured his back and was laid off from work he never dreamed it would be a blessing in disguise. Bedridden for weeks, he decided to start a small mail order business. This was something he could run right from his own home and required very little capital to begin. In fact, Sambati started with less than \$85.00.



After a short time in mail order, Sambati soon had a beautiful home with all the luxuries of a successful businessman.

He figured that a small mail order business might provide a temporary income to support his family until he got back on his feet. His first step was to obtain a franchise from a large wholesale mail order firm which supplied him with all the necessary catalogs and mailing literature. It wasn't long until his spare-time venture blossomed into a booming enterprise. Drawing a small salary and pouring the rest of the profits back into the business, he soon had others working for him! Today he owns a large retail store, his own warehouse and a beautiful home with all the luxuries of a successful businessman.

Sambati's story is typical of a number of men and women who began a small mail order business with absolutely no previous experience, and made a huge success of it. These 'little' people are quietly pocketing big profits every day—many content to keep the business small . . . spending an hour or two each day in the privacy of their own home. No bosses, time clocks or small pay envelopes. No door to door selling, in fact, you never even meet your customers face to face.

Yes, a small one-man mail order business is ideal for anyone wanting a chance to gain financial security and independence. Yet thousands try mail order each year and fail, simply because they don't learn the few simple secrets of success early in the game.

Take the case of Bud Sheer who had been working for a theatre in a small New Jersey town. With only a few hours spare-time to spend each morning, he tried mail order to supplement his regular income. Like many beginners in this field, Sheer was faced with the problem of finding good mail order items which would have a high mark-up and repeat sales potential. But the biggest obstacle was the expense of printing a catalog.

Then he heard about the A. J. Statile Co. of Hillsdale, New Jersey — an organization set up to aid the small mail order beginner.

He wrote to A. J. Statile Co. for full information, sent in his application for a franchise and within a short time the cash began rolling in. Today Bud Sheer owns the theatre he once worked for. Sheer attributes his success in mail order to the A. J. Statile Co. Actually, the theatre he owns has become a side investment.

He still uses the beautiful 300 page mail order catalogs supplied by A. J. Statile Co.

How does the Statile Co. help the beginner get a sound start in mail order? Very simply. Just as Henry Ford made automobiles within the reach of the general public—by mass production and large volume.

Let's take a few specific examples:

(1) All franchised dealers of A. J. Statile are offered ready to mail catalogs and sales literature. Each mailing piece has the dealer's name and address printed right on it. By printing millions of catalogs, Statile is able to offer these at a fraction of their regular cost. The artwork and layout costs for these catalogs would run into thousands of dollars for the beginner if he were starting from 'scratch'.

(2) Since all mailing material and catalogs contain your name and address, all orders come directly to you. Yet you don't have to invest one penny in inventory. All merchandise is stocked for you. In fact Statile has over \$3 million dollars worth of mail order merchandise at your disposal.

(3) All packaging and shipping is done for you. You simply send a shipping label to Statile together with the wholesale cost of the items, and the merchandise is shipped directly to your customers under your own shipping label.

(4) A consultation service is provided to answer any questions you may have. You receive a secret list of over 100 national magazines which run free ads. You'll be shown how to obtain free publicity on your own mail order items. In addition, you obtain trade names and addresses of over 150 other mail order wholesalers who drop-ship top mail order items for you. You'll also be given all the government laws and regulations pertaining to a home operated mail order business. These laws are a 'must' for all beginners.

All this valuable information is covered in the Statile Mail Order Survey which every new franchised dealer receives from Statile before they begin. Formerly sold for \$25.00, this survey has become the 'bible' of the trade. Mr. J. M. of Baltimore, Md., writes, "To tell the truth, all the information in regard to obtaining free ads is alone worth the \$25.00 I paid you . . ." J. D. of Kalamazoo, Mich.,

(Advertisement)

states, "Just a personal note to say I am most satisfied with my \$25.00 investment. Your sales plan is simple and well organized . . ." These are only a few of the many testimonials received praising the Statile Mail Order Survey.

(5) The catalogs and mailing literature offered by Statile Co. cover every conceivable mail order item. You select the field you are interested in . . . **BABY ITEMS, TOYS, APPLIANCES, VITAMINS, BOOKLETS AND**



The thrill of receiving money in your morning mail is one you'll never tire of.

MAIL ORDER COURSES, you name it, Statile has the catalog or mailing piece. Select your market, order your mailing literature and you're in business.

(6) You'll be told how to compile your own mailing lists—and this is the most important part of your business. Many a beginner has fallen by the wayside simply because he mails his catalogs to a poor list of names. Suppose, for example, you offered a beautiful scale model of a 40' Chris-Craft cabin cruiser by mail. You would probably make your mailings to boating enthusiasts and the chances are that nine times out of ten your mailings would show a loss instead of a profit. How would Statile help you solve this particular mailing list problem? He would show you where to get the names and addresses of actual owners of 40 foot Chris-Craft cabin cruisers! Surely every owner would like to have a scale model of his own boat. Strange as it may seem, such a mailing list is available to anyone. The secret is where to find it. This is just one example of how an experienced mail order expert giving you personal advice, may mean the difference between success and failure!

This same method of obtaining selective specialized mailing lists may be applied to practically any market . . . selling baby items to new mothers, selling toys to young children, etc., etc.

So much for starting your own mail order business. Now, a word of caution. **OBTAIN YOUR MAIL ORDER FRANCHISE FROM A**

REPUTABLE MAIL ORDER FIRM. Unfortunately, during the past few years a number of ads have appeared in newspapers and magazines offering to start people in mail order. The ads are grossly misleading. Many imply that you can become a millionaire over night if you use their catalogs. Beware! Particularly if they operate their own mail order business direct to the consumer. These firms compete with their own franchised dealers! They could just as well mail all the catalogs themselves. They don't need you.

Other shady firms fail to drop-ship your orders promptly, thereby losing customers for you. In mail order, prompt shipment is an absolute requirement for a successful operation.

Deal only with firms whose business is preparing catalogs and shipping merchandise. They operate on a strict wholesale basis for franchised dealers exclusively. Such a firm is the A. J. Statile Co. Letters from successful franchised mail order dealers speak for themselves. A woman from Milwaukee writes, "It has been better than my expectations." A gentleman from California states "we are quite pleased with the response we are receiving." Another man from Wisconsin writes, "To say the least, I am more than satisfied."

Yes, a small mail order business offers you an opportunity to earn a second income, or—if you work at it in earnest, a chance to strike it rich. The young housewife in St. Louis may be content to make an extra \$20.00 a week . . . the office worker in Los Angeles may be aiming for \$150.00 weekly full time business . . . and the ambitious schoolteacher in Newark may reach \$20,000.00 a year. What is your objective? Set your own goal, pick your own hours, and the sky is the limit.

Even a government report stated that a number of the most successful one-man mail order enterprises make as high as \$40,000 to



Big firms will carry all stock for you. They ship orders direct to your customers using your own shipping labels.

Your Own Catalogs of Top Mail Order Items!



A. J. Statile Co. will prepare your catalogs, write your sales letters, supply mailing lists and even ship merchandise for you, using your own shipping labels!

\$50,000 a year! But frankly, this is the exception rather than the rule. Most mail order operators are content to earn a comfortable living doing little physical work, but enjoying their work thoroughly! We don't say you'll be a mail order millionaire or another Sears & Roebuck, but if you're looking for a business of your own with financial security, the answer is mail order. If you've already tried mail order with little or no success, don't give up! Try to analyze what went wrong. Success comes only to those who keep trying and learn from their own mistakes. Again we emphasize, deal only with a reputable firm.

The A. J. Statile Co. has been in business for over twelve years.

They gladly furnish bank or trade references upon request. They are probably one of the largest mail order wholesalers in the country. Whether it be toys, gifts, vitamins or appliances—they've got it ready to ship under your label **WITHIN 24 HOURS!**

Firmly convinced that no other business offers the tremendous opportunities of mail order, A. J. Statile, president of the firm, is an outspoken advocate of the man or woman who wants to start in business for himself. As Statile puts it, "by all means, start your own business and start **NOW!** If you want a chance at security and financial independence make your choice mail order. There's nothing like it. Absolutely nothing!"

FOR FREE DETAILS

Mail coupon below — no obligation

A. J. Statile Co., Dept. 24 • Statile Building • Hillsdale 24, N. J.

Dear Mr. Statile:

Please send me complete **FREE** details telling me how I may obtain a franchised mail order dealership with your firm. I understand I am under no obligation and no salesman will call on me.

NAME..... AGE..... SEX.....

ADDRESS

CITY..... ZONE..... STATE.....

PREVIOUS EXPERIENCE, IF ANY.....

(Advertisement)

Not everyone does as well, but T. N. COPY, who started a business of his own, reports...

For 12 months I've averaged

\$800 PER MONTH INCOME

—most of it clear profit for me!

Many men have discovered how to be independent, to be free of layoffs and bosses. C. G. Naples grossed more than \$200 his first week. A father-son combination grossed \$44,000 their second year. H. Lemon says, "I netted \$133 in one 8-hour day."

How much you make depends largely on you. You need no special skill, no large investment. Start part time if you wish.

NO SHOP NECESSARY • Our Electric Deterger shampoos rugs, carpets right on floor—removes dirt and grime and helps to show their natural color and beauty. So efficient and safe it is used by largest railroads and hotels.

► **This is not a lease proposition. You own the machine, you work when and where you please and all the money you take in is your own. You take no risk. Machines fully guaranteed.**



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VON SCHLADER MFG. CO.
111 "R" Pl., Racine, Wisconsin

Without obligation send me **FREE** booklet about your RUG DETERGER and tell me how I can start my own permanent, profitable business.

Name

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City Zone State



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native state; number of terms, years in office. The Declaration of Independence—Sunning 18" x 24" replica on lifetime vellum—hand lettered, hand-signed—priceless memento!

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All 34 Presidential Portraits—Amazing Fact-Finder Wheel—Declaration of Independence

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PLUS THESE TWO FREE GIFTS

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Presidential Fact-Finder Wheel—A twist of the dial shows you each President's order of succession, date of birth, date of death, party, religion;

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310 East 44th St., New York 17, N. Y.
Please send me at **ONE PRESIDENTIAL PORTRAIT** . . . plus a **FREE** **Fact-Finder Wheel** . . . plus a **FREE** **Declaration of Independence** . . . for only **\$1.98** as indicated on box.
It is understood that I will return the **FREE** **Fact-Finder Wheel** . . . plus the **FREE** **Declaration of Independence** . . . to you within 10 days of receipt of my **\$1.98** **IMMEDIATE REFUND IN FULL!**

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AC Spark Plugs' self-cleaning **ACtion** promotes fast winter starts in All Cars



In winter's bitter cold, snow and sleet, AC Fire-Ring Spark Plugs' self-cleaning action promotes fast starts and smooth cold-engine performance. Your spark plugs are clean when you turn the ignition key. The self-cleaning action of AC Fire-Ring Spark Plugs is different from other self-cleaning designs—and better, too. First, it not only cleans by the action of swirling combustion gases, but also by the action of AC's exclusive Hot Tip. This famed AC feature is an extremely thin

deeply recessed insulator tip design that heats fast to burn off fouling deposits as they form. Best of all, AC's self-cleaning action works in all engines.

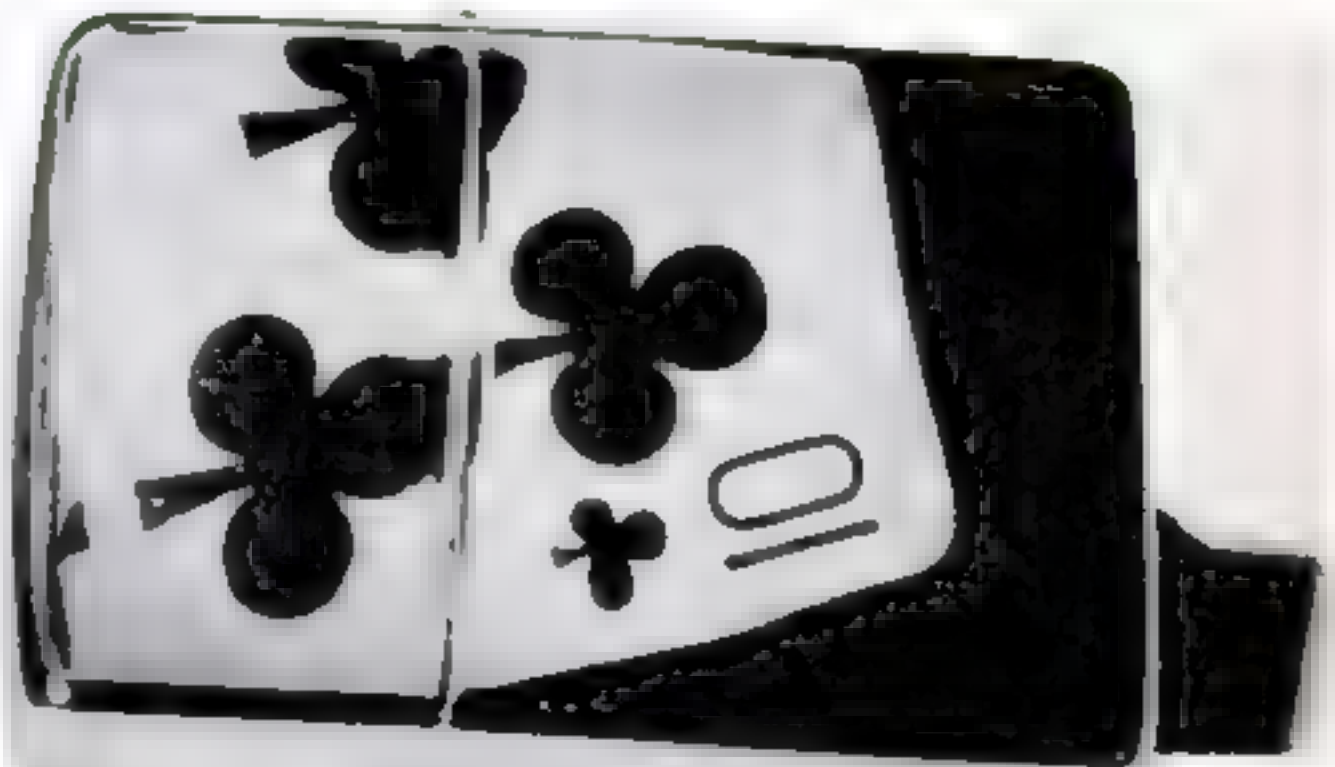
When you buy self-cleaning spark plugs, remember—ACs are built to give you sure-firing performance in every kind of weather, every kind of engine and every kind of driving. Remember, too, you get AC quality only under the AC name. Ask for **ACtion** . . . ask for **AC!**
AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS

FIRE-RING SPARK PLUGS

Who buys all the marked cards and phony dice that are sold? Gamblers, crooks — and maybe one of the boys in your own Saturday-night game

Exposing Crooked Gamblers' Tricks

MIRROR THE CARDS! Nobody's sucker enough for a gag like that. Yet every day scores of sharps get by with deals as shady as their reflectors are bright. "Shiners" such as cigarette lighters, rings, bottle caps, can all be bought by the cheat or easily improvised.



By Joan Steen PS PHOTOS BY W. W. MORRIS

IF YOU'VE gambled more than a few times, the odds are that you've been taken. That goes for penny-a-point gin rummy as well as high-stake poker or crap games.

Worse, it goes for the weekly game with the boys as well as for the obvious suckering of the innocent into a "friendly

little game" with a personable stranger.

Does this sound cynical? Draw your own conclusions from the facts unearthed by the Senate Investigations Subcommittee last fall:

1. In spite of the fact that gambling is illegal in this country outside of a few places like Nevada, scores of companies

Four steps in the gambler's "hop"



Innocent player on cardsharp's right cuts deck but doesn't restack it. Sharp slides bottom half

legally can and do sell crooked dice, marked cards, and as fancy an array of cheating gadgetry as ever marched apace with technology.

2. Hundreds of independent operators use do-it-yourself equipment or even slicker (less detectable) tricks during a game.

Bad enough, but now tie this in: The number of full-time hustlers who work the convention or resort hotels, while not

small, is obviously not enough to eat up more than a fraction of the merchandise sold. Thus the chilling conclusion: A lot of people who buy the crooked gadgets use them to cheat their friends.

What could be more natural? say men like Sidney Radner, a sleight-of-hand lecturer, author, and former undercover agent who exposed gambling frauds in the Army, and John Scarne, another expert called to testify at the Senate hear-

Gamblers' Glossary

Bug: Metal clip used by the card sharp to hold illegal spare cards.

Cold deck: A stacked deck of cards a cheat switches into a game—often after he has dealt the first card of the old deck.

Crap: A French corruption of "crabs"—which is what Englishmen called the unlucky rolls of 2, 3, and 12 in the old game of Hazard.

Deliver the mail: What users of marked cards are said to do.

Drug-store dice: Cheap, ordinary dice as opposed to precision dice.

Flats: Dice shaved so that two faces become oblong, and hence are more likely to fall with one of the larger faces up.

Gaff: The gummuck by which dice become educated and cards well-read.

Gambler's hop: A caper in which the cheat restores the original order to a deck of cards after you've cut them.

Holdout: Any contraption a cheat wears or can conceal under the table to feed him spare cards or dice.

Horses: Mis-spotted dice (top three faces are the same as the bottom three). Available as passers or miss-outs.

Mark: Or chump, birdie, greeny, monkey—all mean sucker.

Mechanic: Any cheat who uses props.

Miss-outs: The dice the sucker plays with.

Painter: A mechanic who marks cards during play.

Paper: Marked cards.

Paper boys: Gamblers who "deliver the mail."

Passers: The dice the hustler uses.

Perfect or precision dice: The more nearly perfect cubes that legitimate gambling houses use and change often—to keep them from biasing.

Percentage dice: The other kind.

Readers: Cards with marked backs. Some require tinted eyeglasses.

Shapes: Another name for flats.

Shiners: Reflectors such as cigarette lighters, bottle caps, and rings, used to illuminate cards.

Square dice: They're legit, too.

Stripper or hump: A card made slightly convex or concave along the sides to suit the crook's needs.

Tops: The popular name for "horses."

Vigorish: The house take in a legitimate gambling house; the honest profit. (In roulette the vigorish is already so high it's not worth rigging the wheel.)



across the top—but then down again, ready to receive the top in the original order.

The "peek" and the "second deal"



1. YOUR EYES are on the four the sharp is dealing in stud. *His* are peeking at next card



2. IT'S AN ACE. But the next player has one showing, this would make a pair. That's bad



3. CHEAT'S LEFT THUMB pulls back the top card (ace) while the right draws out card beneath,



4. AS THE 10-SPOT CLEARS, the cheat restores the top card to position with his left thumb.

CONTINUED



NO BUST HANDS for the cheat who goes on the job with the proper tools. This \$75 "holdout," hidden in his sleeve, feeds him a winning hand on demand. The action is almost imperceptible.

ings. It's easier that way, says Radner. The cheat knows his friends' habits and is fairly sure that they won't be suspicious of him.

What better foils than these for his bag of tricks?

And it's a big bag of tricks. They run the gamut from the miniaturized niceties of transmitter-receiver sets that can tip off who's got the ace—to the nervy crudeness of dice so loaded they can barely turn over. Naturally all along the way nimble fingers are at work to smooth



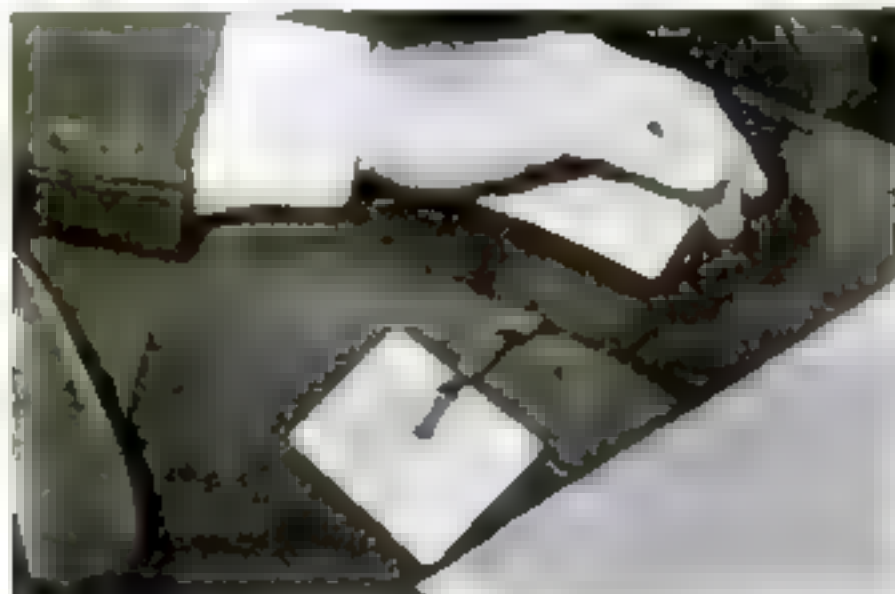
RADIO SIGNALS: Cheat's partner, at secret observation post, taps out signal with transmitter at right. Cheat, wearing a receiver (left) on his leg, feels mild shocks. Cost: \$350.

PHOTOS ABOVE BY NOKI CLARK

the action—sometimes reaching awesome heights of perfection that can do away with all props.

"Paper boys." Take cards +, begin with. Marking them is one of the oldest dodges the cheat uses to gain the upper hand. And it's easy: Playing cards are traditionally so cluttered with designs that an extra shading here, a blotting out or a nick in the edge there, escapes notice.

Novice "paper boys" rely on heavy-handed changes like altering the number



TROUSER "BUG" holds a few spare cards (concealed by jacket or table top). In a smooth



two-second pass of his hand during play, the cheat can exchange his bad cards for good ones.

of birds in a design. Pros favor such subtleties as the hairline thickening of one side of a diamond in the popular diamond-backed Bee playing card. The count across the top to the telltale spot will give the card's numerical value; the particular side thickened will clue the suit.

Cards like these start out as standard decks bought wholesale by distributing companies whose employees then hand-doctor them. When resold, the deck is packed in fresh cellophane and sealed with a new revenue stamp—all nice and legal.

To detect such phonies, give the deck the moving-picture test: Flip through and watch the hot areas—the upper left-hand corner and left side. If you see spots jumping around in a haphazard way, you don't need glasses: The deck has been rigged.

But some marking methods defy such tests. Red-backed cards lend themselves to one of the newer "gaffs." They can be marked with green ink that will show up only when viewed through red lenses. For \$160, the cheat who doesn't wish to wear tinted glasses can get contact lenses—complete with his optometrist's prescription.

Contrary to popular opinion, the hustler who uses "readers" can't read every card, even when he's dealing. But he knows what to look for. So beware of the dealer who never takes his eyes off the cards—and bury your hole card in stud poker if you want to play safe.

Do-it-yourself card "mechanics" may prefer to mark cards during play—sometimes by making tiny thumbtack pricks (the prick is concealed under a bandage usually worn on the thumb), sometimes by sanding the edge of the card with the flick of fine emery paper, just enough to take off a speck of finish.

At the next stage of deception, the cheat uses special equipment or else improvises—sometimes brilliantly.

An example of ingenuity is the cheat's use of a mirror. By passing the cards over it as he deals he gets a complete picture of each hand.

A mirror you say? You don't suppose anyone would be stupid enough to be taken in by that, do you?

Of course not. But a lot of people smoke. And a shiny metal lighter under



MARKED CARDS: One of these is an ace, one a king, and one isn't marked. Concentrating on the tops of the cards, can you crack the system? (Answer at end of article.)



RED GLASSES worn during a game might be suspicious, but contact lenses (at right) are almost foolproof. Both can read the otherwise invisible green markings on red cards.



DICE CHEAT keeps a loaded pair poised between his third finger and pinkie. He picks up the honest pair with index finger and thumb, rattles

all four authentically, and then lets loose with the back pair—in a normal dice-shooting motion. They land seven up.

the dealer's hand will reflect as well as a mirror.

So will certain rings, ladies' compacts, wristbands, and other commercially available "shiners." And so, in one famous case, did a drop of water on a highly polished surface. This clever gambler traveled the club cars of trains. He made sure his iced drink sweated just enough to leave its mark in the right place. Friends just thought he was thirsty.

The more-gadgetry devices for card cheats run to "holdout" machines and "bugs." One such holdout (\$75), strapped to the cheat's forearm, will feed him a tidy full house if he gets stuck with a bust hand in poker. Heavier machines, strapped to the chest, can supply a "cold deck"—one neatly stacked for the cheat to deal at his turn. Bugs are graceful metal loops that a cheat wears on his

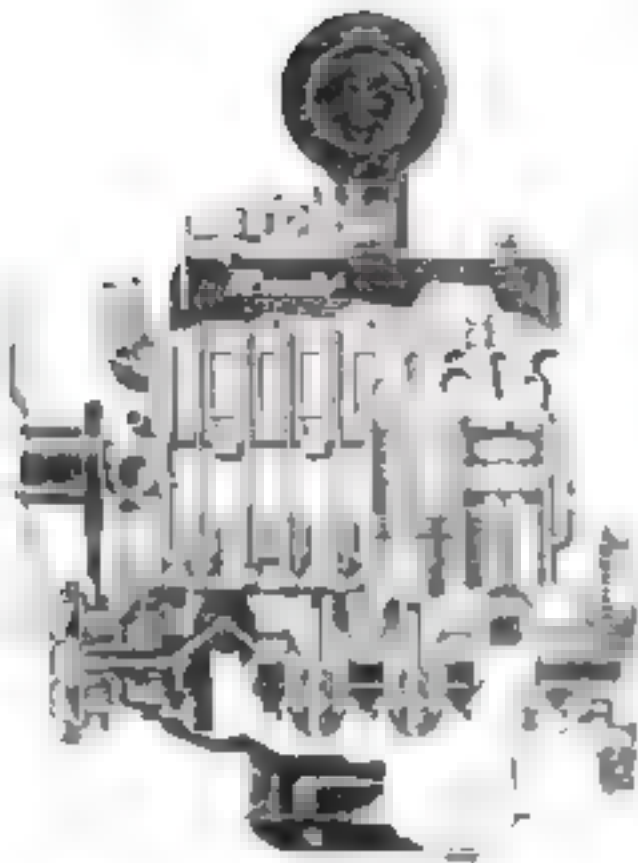
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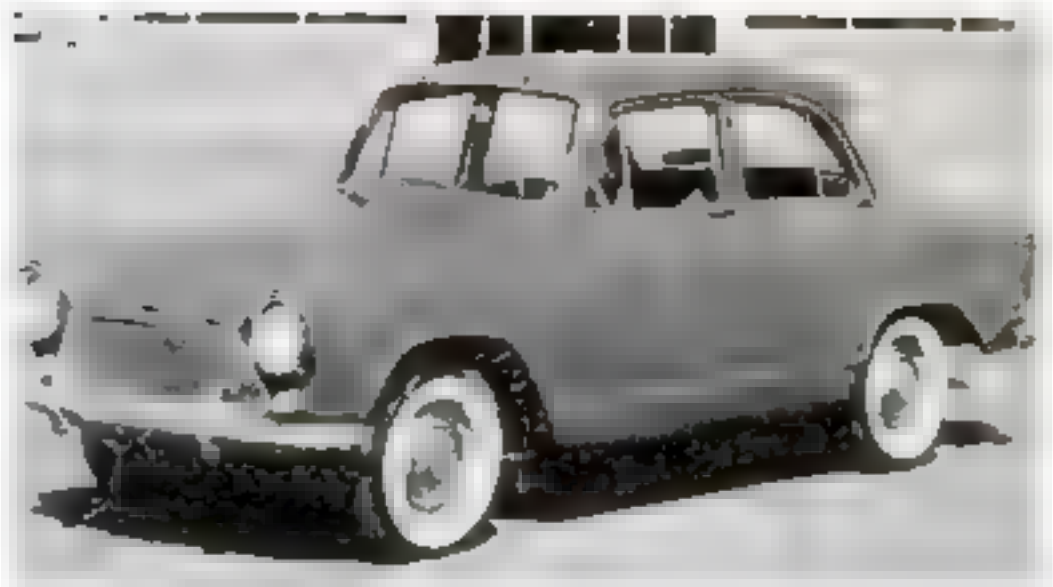
LITTLE MONEY-MAKER: This die is mis-spotted. The three front faces are 1, 3, and 5—but so are the three back faces. The cheat who switches these "tops" into a game can hardly lose.



GAMBLING EXPERT SIDNEY RADNER holds a caliper that can detect loaded dice. On the table are suspected cubes, plus holdouts and shiners—gadgets gamblers use to outwit you.



IN-LINE FOUR has five main bearings, two more than in the earlier model. Centrifugal oil filter is at end of crankshaft. Horsepower rating: 65.



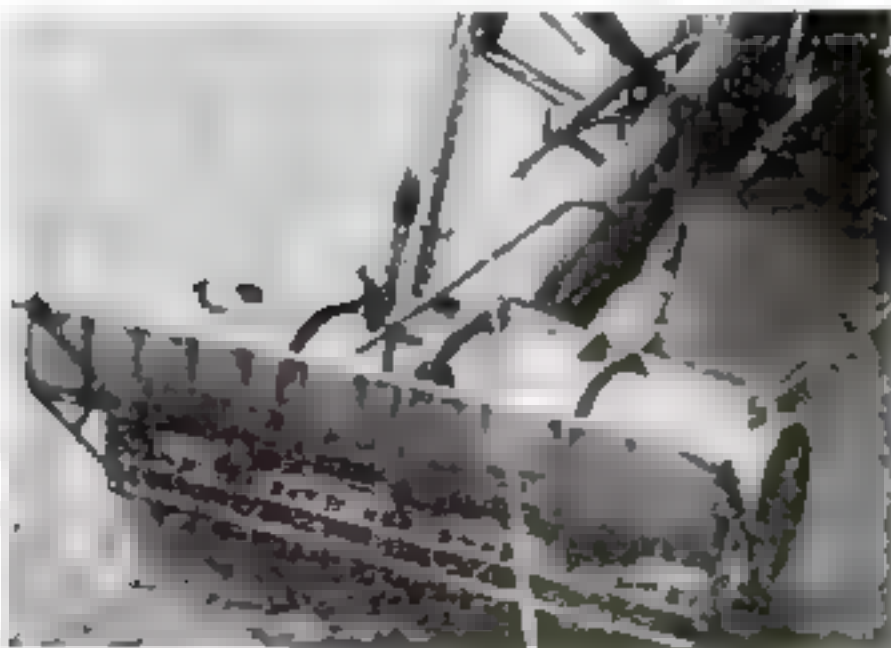
Exterior is unchanged except for modified trim.

A Simca for Americans

The new French-made Simca 5 is designed primarily for American sale. A 30-percent more powerful engine allows the car to keep up with our high-speed expressway traffic. The interior, too, is Americanized, now boasting pleated vinyl upholstery. A swing-needle speedometer, key-operated starter, relocated hand brake, and manual choke are featured. Price: \$1,650—a \$117 cut.

To be read with a mirror

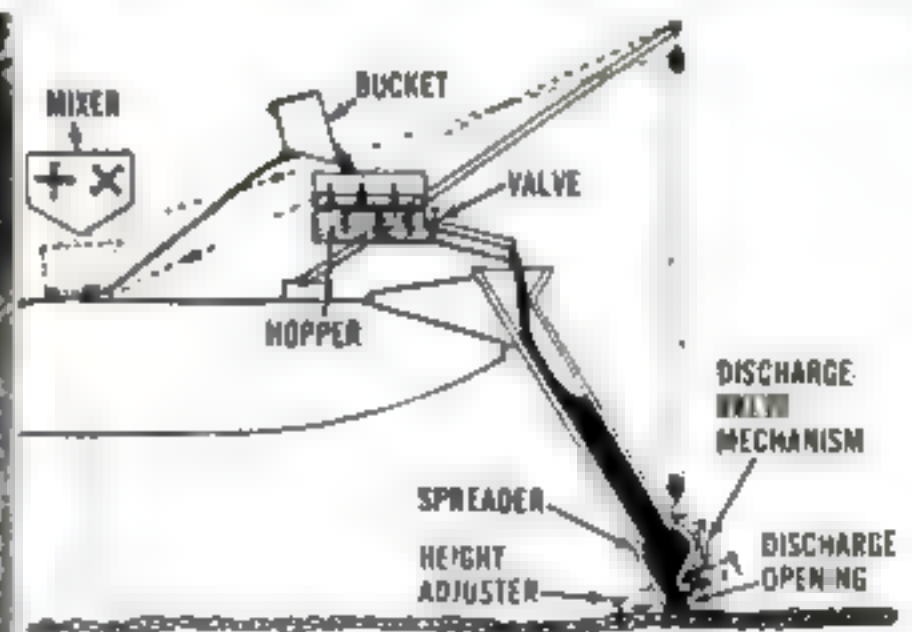
The backward-printed lettering on the hood of the ambulance in the photo at right isn't a mistake. It was put on that way purposely by the Veterans of Foreign Wars, who operate an emergency service in Suffolk County, N. Y. The sign is for rear-view mirrors of cars the ambulance wants to pass.



UNDERWATER SPREADER, mounted on shallow-draft barge, lays strips of hot asphalt up to 17 feet wide on 60-foot-deep sea floor.

Paving the bottom of the sea

A reverse dredge lays a carpet of asphalt to build defenses against the sea in Holland. The pavement provides a base for caissons sunk to close gaps in dams



LOADING BUCKET conveys thick liquid from mixer to hopper where it is kept fluid by churning and fed through chute into spreading arm.

across estuaries and rivers, and prevents erosion of the bed by swift currents. Heaters keep the material liquid, at 200 degrees, so it will flow in the cold water. The machine was designed by Royal Dutch Shell.

FOR the third year, Popular Science presents a series of articles on the new cars unique in magazine journalism: the results of 10,000 miles of driving—a year's normal mileage—in one month. In 1960 we reported on the Corvair, Falcon, and Valiant; in 1961 on the Tempest, F-85, and Lancer. In this, the first of several articles on the 1962 cars, we tell you about the virtues and shortcomings of Chevrolet's first four-cylinder car in more than three decades, the remarkably contradictory Chevy II.

Testing the New Four-Banger:

10,000 Miles in a Chevy II

By Devon Francis

EVER since Ford introduced its Falcon in the autumn of 1959 and began winning the compact-car popularity contest, it has been a virtual

certainty that Chevrolet would bring out something to match it. Now Chevy has.

Chevy not only has seen the Falcon, but, as the brethren around a poker table

HOW THE CHEVY II DID



THE PERFORMANCE

Total distance covered	11,014 miles
Gasoline used (nonpremium)	519.3 gal.
Average miles per gallon	21.2
Oil burned	None (*)
Gas mileage at constant speeds	
30 m.p.h.	29
40 m.p.h.	27
50 m.p.h.	25
60 m.p.h.	24
Gas mileage in stop-and-go driving	20
Acceleration	
0-60 m.p.h.	17 seconds
40-60 m.p.h.	11 seconds
50-70 m.p.h.	12 seconds

Top speed 90-plus m.p.h.
Speedometer error

Indicated Speed	Actual Speed
40 m.p.h.	40 m.p.h.
50 m.p.h.	50 m.p.h.
60 m.p.h.	60 m.p.h.
70 m.p.h.	68 m.p.h.

THE COSTS

Gasoline	\$169.57
Oil burned	00.00
Gas-oil cost per mile	.0153
Repair and maintenance, including adjustments at 500, 1,000, 5,000, and 10,000 miles	
Oil and filter changes	\$ 3.25
Lubrication	3.70
Tune-up (parts)	2.00
Total labor	20.85
Total	\$29.80

Over-all direct operating cost per mile \$.0181

*Not counting oil changes.



Excellent steering made the car a pleasure to drive on winding roads in the Rockies.

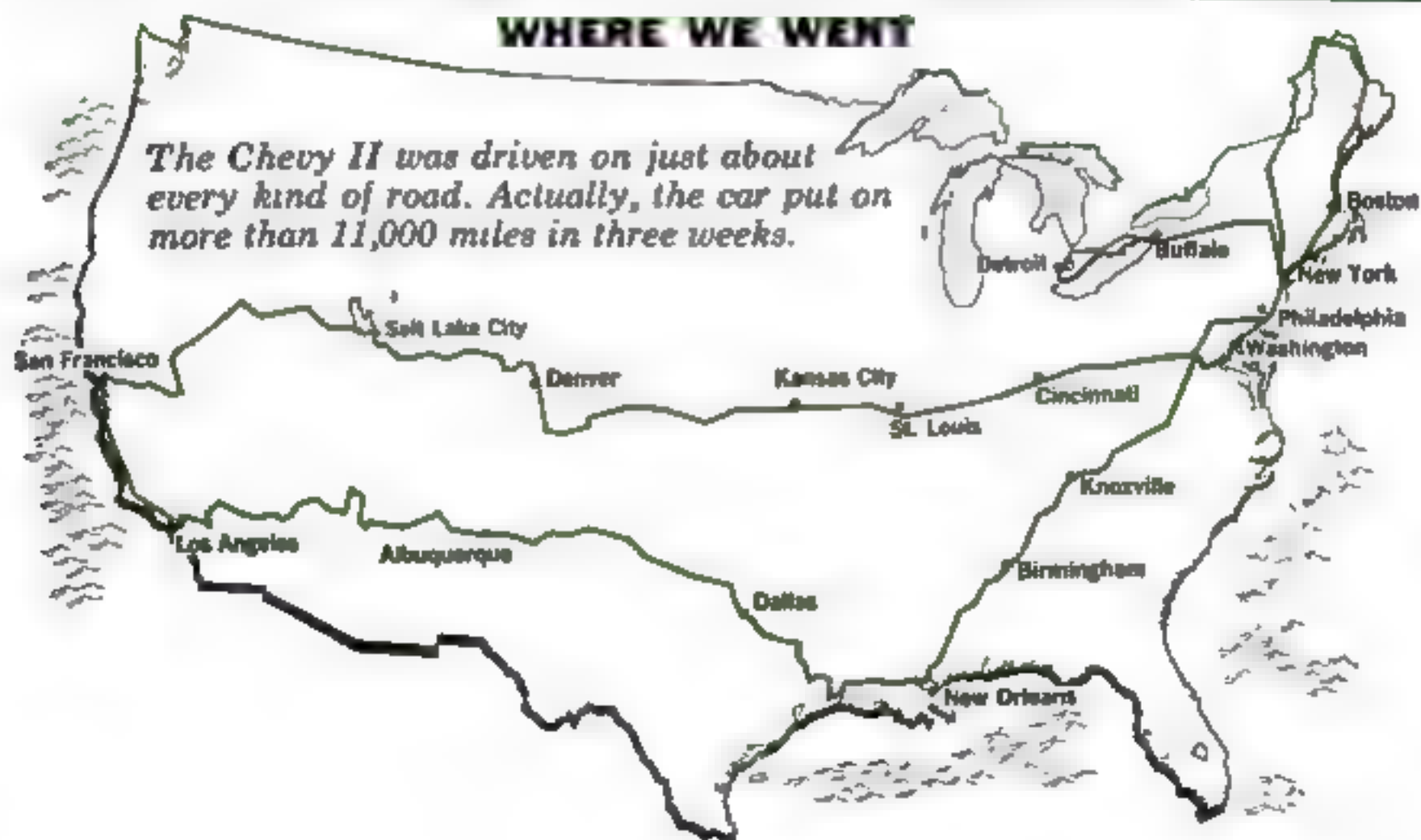
would say, has raised it in spades. If Ford could have a six-cylinder car that measured its gas consumption with an eye dropper, Chevrolet could have one with four cylinders. That's the Chevy II.

How good is this latest automobile bearing the name of the world's biggest-selling car? Do four good-size bangs get you farther on a gallon of gas than six medium-size ones? How responsive is the engine at sea level, in the rare air of mountain passes two miles high? How

does the car handle on gently curving turnpike, on snaky mountain road? What is its most beguiling trait, its worst fault?

To find the answers to these and other questions, POPULAR SCIENCE editors drove the Chevy II from Maine to California, from Canada's province of Quebec to the limitless plains of Texas. For good measure, to learn a woman's reaction to the car, the wife of one staff member undertook her share of the driving.

Not everybody agreed—which was half





Stopping to stretch in Yosemite. Car wasn't peppy at altitude of 10,000 feet.



A noontime desert crossing at 80 m.p.h. didn't overheat the little engine at all.

the fun of preparing this report for you.

The Chevy II was purchased at its full retail price of \$2,143.50 from a regular dealer. It was a manual-shift, four-door sedan with radio, heater, seat belts, and outside rear-view mirror as sole accessories. **POPULAR SCIENCE** deliberately chose to test the four-cylinder version of the car. The car is also offered with a more-muscular six-cylinder engine.

Here is our round-table discussion of the Chevy II:

Fuel Consumption

Hubert Luckett: During break-in the car was giving around 19½ miles to the gallon, mostly on open-road driving.

Howard Allaway: The engine was stiff then. I suppose the mileage got better?

Frank Rowsome Jr.: Stiff was no word for it. That engine was so tight that it hardly burned a drop of oil in 10,000 miles. Yes, the mileage did get better. Without babying it, we often got more than 25 miles to the gallon.

Luckett: To be precise, I found that it gave 27 miles to the gallon at a steady 40. This was with better than 10,000 miles on the clock, with the fifth wheel and fuel-flow meter hooked up. The mileage stayed high at faster speeds—25 at a constant 50.

Devon Francis: The log shows that no oil was added throughout the entire run. In fact, only once, when we were changing the oil anyway, was the level down as much as a quart.

Handling

Wesley Griswold: The shifting bothered

How the Chevy II compared with PS's 1961 Tempest, F-85, and Lancer; and 1960

	Chevy II	Tempest	F-85	Lancer(*)
Over-all average miles per gallon.....	21.2 m.p.g.	20.25 m.p.g.	20.21 m.p.g.	16.3 m.p.g.
Gas mileage at constant speeds				
30 m.p.h.	29 m.p.g.	28.4 m.p.g.	27.9 m.p.g.	21.8 m.p.g.
40 m.p.h.	27 m.p.g.	27 m.p.g.	26.8 m.p.g.	20.8 m.p.g.
50 m.p.h.	25 m.p.g.	24.9 m.p.g.	24.9 m.p.g.	18.4 m.p.g.
60 m.p.h.	24 m.p.g.	22 m.p.g.	21.8 m.p.g.	16.1 m.p.g.
Miles per gallon in stop-and-go driving . . .	20 m.p.g.	18.7 m.p.g.	15.03 m.p.g.	13.8 m.p.g.
0-60 acceleration	17 sec.	13.5 sec.	13.8 sec.	11.2 sec.
Top speed	90-plus	96-plus	100-plus	92 m.p.h.
Total oil consumption	None	1 qt.	4 qt.	4 qt.
Gas-oil cost per mile	\$.0153	\$.0163	\$.0162	\$.0203
Over-all direct operating cost per mile . . .	\$.0181	\$.0186	\$.0172	\$.0246

(*) Lancer had optional larger engine, automatic transmission, special "performance" axle.



At Grand Canyon: With seat full back, car is comfortable in front for six-footers.

me. It's hard to get into low quietly. I killed the engine several times as the light turned green. The torque is poor at low speeds.

Martin Mann: This engine-transmission combination is a headache in traffic. You can't turn a corner without shifting.

Francis: Oh, come now! That's true in most stick-shift compacts.

Fay Rowsome: Yes, but it's no fun having to stay in first or second gear all the way across a city.

Allaway: There's just no right way to drive the car, with this engine-transmission-axle combination, at around 30 miles an hour. It lugs in high and it's shrill in second.

Rowsome: I grant you it would be happier with a four-speed box. But the car is perfectly all right if you drive it sympathetically. It goes briskly if you just shift it late—into second at around 20, and into high at, say, 39. In traffic, you just have to down-shift it soon. It's true that you often need low while you're still

How the Chevy II's Tires Stood Up

A tire expert measured tread depth at 11,014 miles. The 6 00 x 13 Firestone tires had been rotated at 5,339 miles while on the California leg of the test. The right front tire had lost 36 percent of its tread, the right rear 32, the left front and left rear 41, and the spare 23. His estimate of projected tire life for the five tires: 38,500 miles.

rolling, which calls for double-clutching.

Allaway: The steering and all-around stability are positive delights. I found no fault with the car on twisting, hilly back roads. The brakes seemed fine, too.

Rowsome: I thought that the steering was fine—precise, quick, and fairly neutral in the corners. And the car is docile in a slide.

Luckett: For me, I missed that feeling of security in control that you get in the Olds F-85 or Valiant.

Corvair, Falcon, and Valiant

Corvair	Falcon	Valiant
23.43 m.p.g.	26.56 m.p.g.	20.31 m.p.g.
26.8 m.p.g.	30.2 m.p.g.	25.8 m.p.g.
24.2 m.p.g.	29 m.p.g.	24.2 m.p.g.
23.6 m.p.g.	28.1 m.p.g.	23.9 m.p.g.
22.6 m.p.g.	27.1 m.p.g.	22 m.p.g.
21 m.p.g.	22.4 m.p.g.	19.6 m.p.g.
17 sec.	22.9 sec.	17 sec.
88 m.p.h.	78 m.p.h.	96 m.p.h.
4 qt.	1 qt.	3 qt.
\$.0145	\$.0122	\$.0163
\$.0184	\$.0147	\$.0206



But it's a small car, as the picture proves—a loose fit for a giant Sequoia tree or a little garage.

How Well Was It Designed and Built?

Except for an engine-transmission combination that may not suit many drivers, the Chevy II that POPULAR SCIENCE bought was a well designed car. Fuel and oil economy were excellent. Assembly and preparation, however, left something to be desired. Here were some faults:

- It took several weeks of intermittent work to silence an assortment of buzzes and rattles under the dash and hood. Rattles in the shift linkage and clutch appeared uncorrectable.

- The crankshaft V-belt pulley had a 3/16-inch runout.

- Transmission whine, especially on the overrun, was louder than usually acceptable on Detroit cars.

- As delivered, headlights were misaligned, idling speed was misset, and vent panes were very stiff.

- By 1,000 miles, rain leaks developed by the toeboard and in the trunk.

- Wind noise was high unless the car was shut up tightly.

Mann: It seemed to me that she heeled a bit on turns. I will say, though, that I didn't find it wind sensitive.

Luckett: I did.

Rowsome: It wasn't excessively wind sensitive.

Luckett: It was a bloody nuisance.

Mann: No, no, no! I drove through Vermont on a day so windy you had to brace yourself to walk. But I didn't know the wind was blowing until I got out of the car.

Francis: While you guys wrangle about wind, let me say I thought that the handling was generally good.

Allaway: So did I.

Rowsome: Yes. This car was a joy on switchback mountain roads.

The Ride

Luckett: The ride's only fair.

Mann: It's not soft enough to smooth out many ordinary bumps. Expansion joints on concrete roads can get through to you.

Griswold: Well, there is a little pounding and thudding on ordinary roads. But it gets very little worse on really terrible roads.

Allaway: The ride seemed a little harsher than the Falcon's. It's certainly not as smooth as the one in the luxury compacts.

Rowsome: I liked it. You've got no crisis when you go sailing off the smooth road onto a sudden detour. There's remarkably little pitch. And even with a fair load it doesn't bottom.

Griswold: For cross-country driving the car is sprung just right for me.

Performance

Fay Rowsome: What pleased and surprised me was the way the car behaved on the open road for hour after hour.

Griswold: You mean at considerable speed. Yes, I agree.

Fay Rowsome: It cruised comfortably at 70 and even 80 miles an hour without any apparent effort.



Steep wet streets of Quebec posed no problem—in low or second, not high.



Bilingual signs are used in French Canada. Suspension is anti-dive.



After completion of 10,000-mile run but without tune-up, the acceleration, fuel consumption at constant speeds, and speedometer error were measured with a calibrated fifth-wheel instrument. Results are shown in table on opening page.

Francis: Passing acceleration at, say, 55 or so seemed okay.

Luckett: Yeah, but if you try passing at 40, just be darned sure you've got the space to do it in. In high gear you haven't got the steam. In second you have already run out of revs.

Mann: Getting up hills without a run is a science all its own in Chevy II. The car takes forever to accelerate. You have to send written orders in triplicate to the engine room. Eventually some more m.p.h. comes out at the rear wheels.

Rowsome: Go on! The only times we found it tired was at altitudes around 10,000 feet, when any engine is feeble.

Francis: Let's be fair to those four cylinders. The car's top speed is well over 90. It accelerates fine above 50.

Allaway: Nobody could complain about the acceleration from cruising speed.

Rowsome: I suspect some of you guys

have forgotten how to shift gears. The car has fine acceleration at any speed if you just shift quickly and at high revs.

Luckett: That's right. Did anybody else check the zero-to-60 figure against the other compacts? If you didn't, you'll be surprised. [See box.]

Design and Construction

Allaway: Wind noise from the vents is a real conversation stopper.

Griswold: There's no drain on the transmission. You have to get the lube out or in by loosening support bolts. All in all, though, I thought the car was good and solid. Especially the doors.

Luckett: Did you notice the sheet metal quiver when you slammed the door? And there were some annoying buzzes and rattles under the dash.

Rowsome: We managed to hunt down

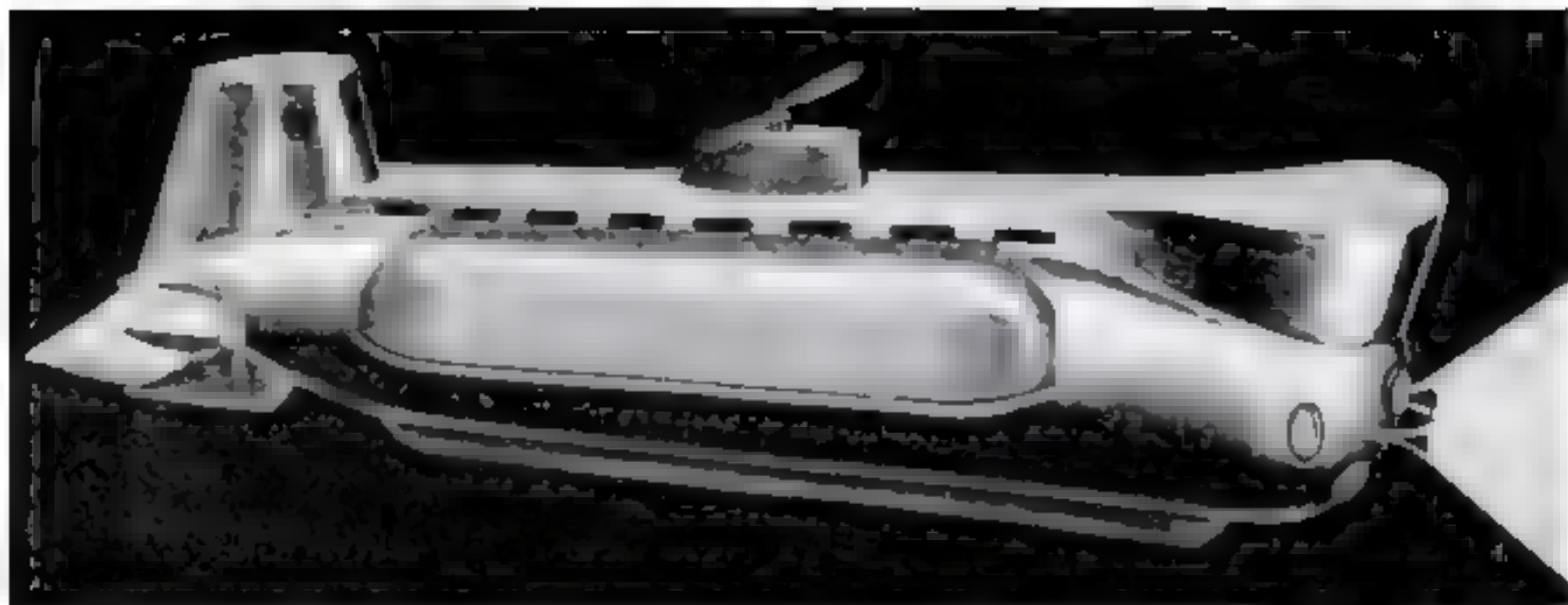
[Continued on page 212]

How the Cover Picture Was Made



The car apparently charging across the landscape on the cover of this issue was not really going anywhere. The trick is a double exposure with a reverse twist. Photographer O. Winston Link first made an exposure (1/5 sec. at f/45) with the car

standing still, to produce the clearly defined image. He then added the "speed lines" by a second exposure on the same film (1 sec. at f/65) with the car taking off—in reverse—while the shutter was open.



Aluminum submarine is deep diver

The odd-looking submarine shown in the drawing above will be the first of its kind when completed next year. It will have an aluminum hull and be designed to dive 15,000 feet for explorations of the ocean floor. What appear to be eyes and mouth are lookouts for its three-man

crew. The helicopter-like rotor on top will permit it to hover under water at a given spot. General Dynamics is building the Aluminaut for Reynolds Metals Co., which will lease it to the Woods Hole Oceanographic Institution for an extensive Navy-sponsored research program.



Solar-electric power plant

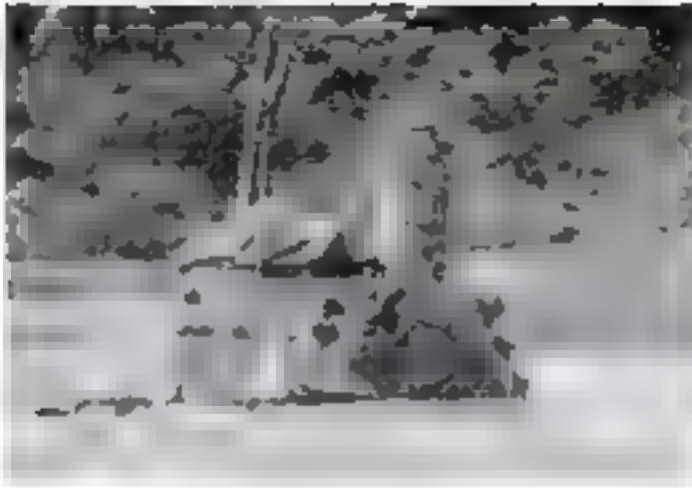
Sunlight concentrated by the reflector on a new thermoelectric generator is hot enough to deliver 200 watts of electricity or, as above, to ignite a stick of wood. Westinghouse developed the solar power plant to convert sun rays into electricity that will run a pump. It could irrigate four acres of land or supply water for 1,200 persons.



Television screen stands on its end

To get bigger close-ups of missile launchings on closed-circuit TV monitors, GE is now making a vertical picture tube. It eliminates landscape at the sides of horizontal screens and devotes more space to the missile.

To make the idea work, GE not only had to rotate the picture-tube components 90 degrees, but had to turn those in the camera pickup tube as well.



Army tank fords rivers

For river-crossing tests under combat conditions, the Army tank command at Fort Knox, Ky., has come up with a clever trick.

It cut the ends out of a 55-gallon drum and fitted it, with a leakproof gasket, over a tank hatch. The drum provides a command lookout, air for crew and engine, and emergency evacuation in streams up to 12 feet deep. Snorkels vent engine exhaust.



Dash alarm alerts driver to icy road

A bumper-mounted detector resembling a fog light warns of ice on the roadway ahead.

The Scottish-built device has a temperature-sensitive electronic probe centered in a beaming reflector. When air at pavement level drops to $35\frac{1}{2}$ degrees, a light flashes on the dash. As the freezing point nears, length of flashes increases. When it's reached, the light stays on.



All-electric station wagon

A new battery-powered automobile will hit U.S. highways early this year. The Stuart Electric is intended for use as a second family car that will be driven only a few miles a day. Its eight conventional six-volt batteries are good for 35 miles on an overnight charge of household current.

The station wagon has a fiber-glass body, is 115 inches long, seats two adults and two or three children. Stuart Motors, Kalamazoo, Mich., sells it for \$1,600. A commercial model is \$1,500.

Braille numbers on clock's face

The clock at right has numerals in Braille for telling the time. It was set atop the Industrial Home for the Blind in Jamaica, N. Y., as a reminder to commuters using the nearby Long Island Rail Road that there is such a home.



Revolving six-decker hen coops

Hens on a poultry farm at Funabashi, Japan, are pampered into laying more eggs by being cooped in six-story "apartments" that provide equal sunlight for all. Powered by one-hp. motors, coops revolve so each gets sun every 45 minutes.



LATEST MODELS of Samos and Midas "space eyes" are believed to have winglike panels of solar cells—dispensing with heavy batteries for power, and giving longer operating life for electric equipment.

Space Cameras on Peace Patrol

Can satellites replace the U-2s as warning "eyes"? America is betting the answer is yes

By Robert S. Strother

SOON after flights of America's U-2 photo planes over Russia were canceled in May, 1960, Thomas E. Gates Jr., then U. S. Secretary of Defense, made a surprising statement to

the Senate Foreign Relations Committee.

From thousands of photographs taken at great height during the four-year series of surveillance flights over the hidden heartland of the Soviet Union, said Gates, "we got information on airfields, aircraft, missile testing and training, nuclear-weapons storage, submarine and atomic production, and aircraft deployment." That data, "pieced together and associated with intelligence from other sources, gave a very definite look-see at their military posture."

This was news of top importance. The amazing power of our high-altitude cameras in piercing the Iron Curtain had gone much further than had been supposed to reduce the "intelligence gap" between the open American society and that of the Russian garrison state with

GIANT LENS as tall as a man reportedly is planned for camera of '63-model Samos. Secret focal length is to be the longest ever used.

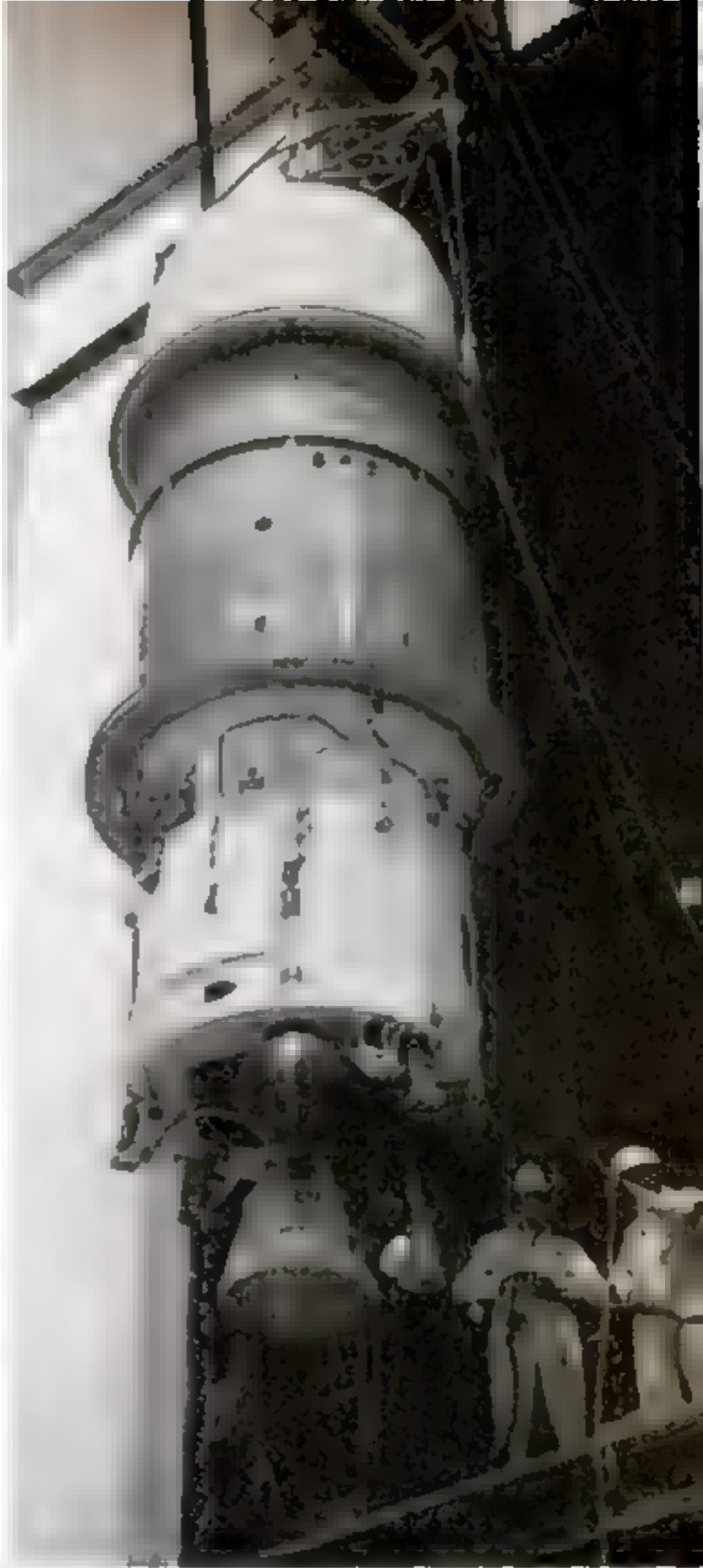


its fanatical cult of secrecy. By permitting a continuing assessment of Soviet missile progress, the pictures, along with tape recordings of Russian internal radio and radar messages, provided a measure of strategic warning against surprise attack. Moreover, they were in themselves a strong deterrent to war. Khrushchev could assume that the cameras had pinpointed, with map coordinates and range data for American bombers and missiles, such Red installations as Kapustin Yar, the great missile test center and launch site southeast of Stalingrad where Sputnik I was launched, and Tiura Tam, which is the Red version of Cape Canaveral.

"Indispensable." President Eisenhower put the value of the "overflights" bluntly in a telecast aimed at world opinion. Success in "ferreting out" information on the military preparations and attitudes of a threatening great power in this era of intercontinental nuclear weapons, he declared, "is indispensable to free world security."

Cancellation of the U-2 flights, therefore, raised a portentous question. The United States was renouncing the use of its most successful intelligence-gathering instrument—the aerial camera—just when Russian missile and space technology was advancing with giant strides. What could take its place? Specifically, could an automatic space camera be built with power enough to do, from a satellite in orbit several hundred miles above the earth, the job the manned U-2s had done less than 20 miles up?

In project Samos (for Satellite and Missile Observation System), the Department of Defense is betting millions of dollars and a sizable part of the nation's technological skills that the answer is yes. For nearly a year now the 4,100-



SAMOS SATELLITE consists of secret photo equipment built into an Agena second-stage rocket. Launched from the ground by an Atlas booster, Agena puts camera gear into orbit about 300 miles high. Model pictured above is an early Samos.

RECOVERABLE CAPSULE (left), of the kind developed in Discoverer experiments, may soon bring Samos films back to earth. So far, Samos has radioed its pictures to ground; retrieving the films will give sharper and more-revealing views.



pound Samos II, its nose loaded with intricate automatic photographic gear, has been whirling in a polar orbit that takes it across the Soviet Union seven times a day at an altitude slightly above 300 miles. And work is being rushed on a more advanced operational model.

Prime contractor for Samos is Lockheed Aircraft, designer of the U-2. Almost daily, Air Force officers in civilian clothes wait impatiently in the laboratories of Lockheed, Itek Corp., Eastman Kodak, Perkin-Elmer, Aerojet General, General Electric, and other firms for key components to be completed. Parts are rushed in unmarked trucks to test centers known only to the officers and scientists at work on the new model.

Samos' mighty eye. Although Samos involves vast problems in space marksmanship and control, the heart of the system is a prodigious camera embodying many great and largely unheralded advances in aerial photography. The notion of a robot camera in space seemed a wild pipe dream when Air Force "anticipators" began feasibility studies of it 15 years ago—when satellites existed only in science fiction. The best World War II reconnaissance cameras used lenses of 48-inch focal length (that is, 48 inches from lens to film). Flying at 60,000 feet, or 11 miles, they could photograph an area two miles square, and the pictures would show objects as small as two feet across.

Greater focal length would let still smaller detail be photographed, but the task of designing a longer camera bristled with difficulties. For example, the refractive quality of light changes at very high

altitudes. So do pressures and temperatures. To keep a sharp focus, each of the elements in the compound lens system would have to be adjusted separately to the changes. Sharp aim, too, was a problem. An airplane is an uneasy platform, and the greater the magnification of the lens, the greater the need to hold the camera rock-firm. Aerial cameras were usually mounted on tables kept level by gyroscopes, but a camera longer than 48 inches proved unmanageable.

Bouncing the image. Brig. Gen. George W. Goddard, then chief of the Wright Engineering Laboratories, in Dayton, Ohio, had already sparked a series of swift advances in long-range photography, with the help of such optical experts as Dr. James Baker of Harvard, Dr. Duncan McDonald of Boston University, and Dr. Amrom Katz of his own staff. They had developed an aerial lens that utilized the "folded optics" principle of binoculars. Instead of admitting light through a long, straight barrel, this instrument bounced it in a figure-4 pattern around mirrored corners. As a result, it increased the focal length of the lens without increasing the length of the camera itself. Following this lead, the Goddard group now developed a powerful, compact 100-inch aerial camera of great acuity and accuracy, thanks to a super-gyroscope.

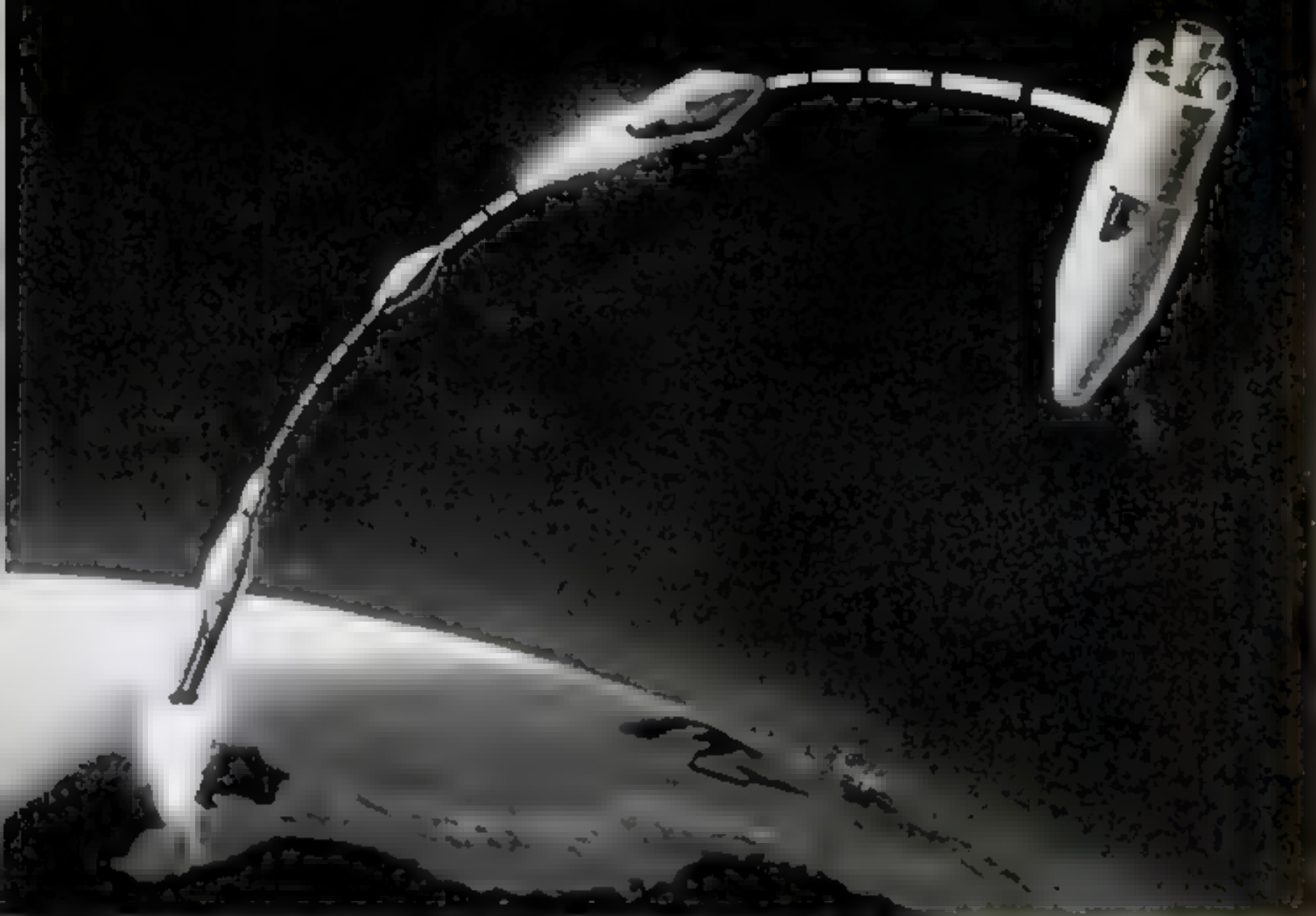
In the Washington office of Itek Corp., General Goddard handed me a 9-by-18-inch picture taken by the 100-inch camera in 1949. It shows a putting green at a Fort Worth golf course, with a caddy holding the flag for two players. And visible on the putting green are two golf balls!

"Pretty good for eight miles up," the general said. "And that was a dozen years ago. We can't talk about recent advances, but you can be sure we haven't been standing still."

The most powerful camera announced so far is the Perkin-Elmer Roti satellite missile tracker with a focal length of 500 inches—nearly 42 feet—and an objective lens two feet across. From the ground it has made good pictures of orbiting satellites hundreds of miles high. Official silence cloaks the specifications of the Samos II camera. But the trade-press predictions were that it would have a focal length of more than 40 feet, and be

TV CAMERA of a hurricane-hunting Tiros satellite gave this view of French West African coast. To reveal military activities, larger-scale and sharper photos are required.





LAUNCHING A SAMOS or Midas is done this way. In successive phases, left to right, Atlas booster blasts off; Agena second stage coasts

free; ignited Agena reaches orbital speed of about 18,000 m.p.h.; orbiting satellite tilts itself to stabilized nose-down position.

able to distinguish 12-inch objects against a contrasting background from 300 miles out in space.

From the race track. One requirement for space photography is motion compensation. Samos II is traveling at least 17,000 m.p.h. How can blur be avoided in pictures taken at such high speed? The engineers found the answer at the race track, in the principle of the photo-finish camera. A motor controlled by an electric eye pulls a strip of film across a slit in the camera at just the speed needed to offset the motion.

In Pentagon photo files are two celebrated pictures made by an aerial version of the race-track camera. One photo was triggered from a plane flying at 3,000 feet just above a runway where four air-men were posed in a pretended card game. The faces are recognizable, and one of the players holds up a card—a clear, unblurred ace of spades. Another picture was snapped by a second plane flying above the first and in the opposite direction. Despite the combined speed of 1,000 m.p.h., the picture shows individual

rivets in the wing of the lower plane.

But the operational Samos camera must do even more. In a north-south polar orbit, it makes 15 trips around the planet daily. Since the earth below is rotating from west to east, 1,500 feet per second at the equator, motion compensation in two directions—sideways as well as forward—is required. Presumably, Samos II uses extremely fast film in a camera that both nods and yaws as the shutter opens.

A "fix" for each shot. Unparalleled accuracy also is required of the Samos camera in identifying locations photographed. Since the stars are always visible at satellite altitude, Samos will get a "fix" for each ground shot by photographing the stars directly above it simultaneously through a small auxiliary camera.

Aerial intelligence will not be confined to photography by visible light. Infrared-ray or "dark-light" photography, which makes targets visible in the blackest night, is far advanced. So is radar photog-

[Continued on page 213]



Cold Facts About Snow Blowers

How much snow should a snow blower throw when a snow blower's busy throwing snow?

By E. F. Lindsley

I'M A sucker for snow blowers. I'm so fascinated with these little bundles of whirring blades and chugging engines that I can hardly wait for it to snow.

But it wasn't always like this. It took four machines of my own, plus dozens of others I tested, to teach me that snow blowers can be as unlike as a kiddie car and a Cadillac. My first one was a decidedly unlovable little hand-pushed job that stubbed its toe on every crack, came to an abrupt halt against any drift taller than 6", and hurled what little snow it did pick up right back in my face.

Moral: If you're dreaming of strolling in a leisurely way behind a magical contraption while the white stuff sails off in a long, shimmering plume, just stay awake long enough to pick a machine that will really do the job. Modern snow blowers are marvelously complex pieces of machinery, but they're designed for widely differing uses and budgets.

The capacity nonsense. Makers engage in a wonderfully sly bit of double-talk on the prowess of their blowers. One tells

you its machine "will discharge 300 shovelfuls of snow a minute," another "1,500 pounds a minute," a third "85 feet a minute," while a fourth will "do the work of 10 men."

Unless you like converting pounds, feet, shovelfuls, and man-hours, you're better off ignoring the double-talk and looking instead for the features that are the real tipoff to quality.

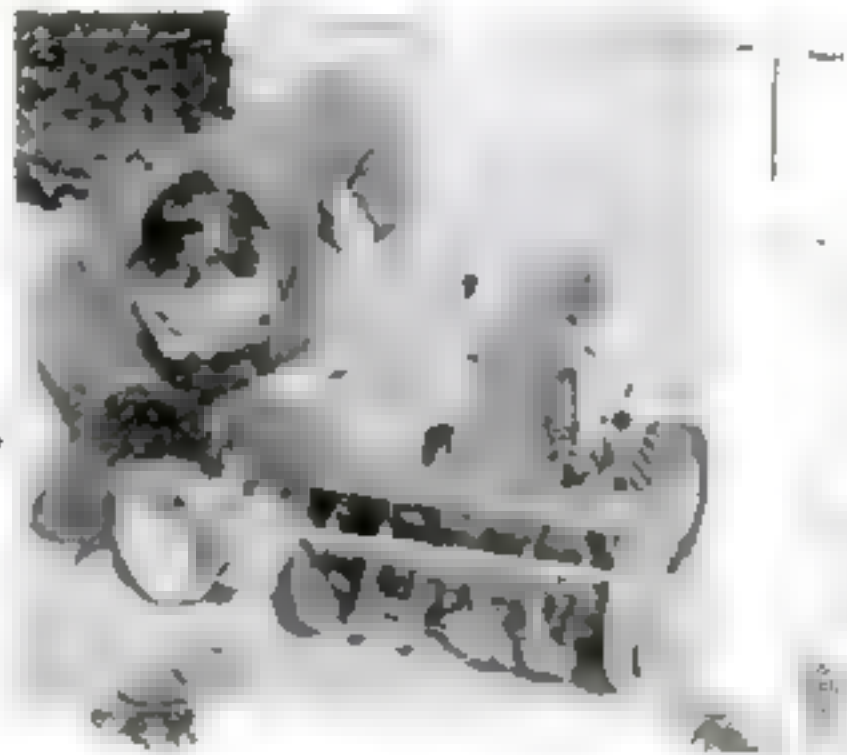
Capacity ratings are largely meaningless anyway, because so much depends on the depth of the snow, whether it is wet, dry, fluffy, or packed, and the kind of terrain that you have to navigate on. Often, too, speed of removal is not as important as thoroughness, ruggedness, and ease of handling.

Who makes them? Snow blowers divide roughly into two groups: those sold by companies long established in the garden-tool business, such as Ariens, Jacobsen, Simplicity, Reo, Toro, Bolens, and big mail-order houses. There are also a few fine independents with good reputations. But there's another group—scores of small, here-today-gone-tomorrow operators who throw together a bargain ma-



◀ **ROTOR-TYPE BLOWER** uses a vaned blade to sling snow. On this self-powered Jari model, the chute tilts to either side, also reversing blade rotation for correct direction of throw.

AUGER-TYPE BLOWER ▶ has a screwlike blade to pull snow into the scoop. Blade width is important to check—here 20". Note also heavy tires and swivel chute on this self-powered Jacobsen.



Buyer's Guide to Snow Blowers	TYPE	RATED HORSE-POWER	WIDTH OF CUT	TYPE OF CHUTE	NUMBER OF STAGES	FORWARD SPEEDS	POWER REVERSE	APPROX. LIST PRICE
ARIENS	Self-prop.	3½	24"	Swivel	2—auger & rotor	4	yes	\$239
	Self-prop.	5½	34"	Swivel	2—auger & rotor	4	yes	\$299
BOB-CAT	Self-prop.	3½	20"	Swivel	2—auger & rotor	1	yes	\$261
	Self-prop.	5½	20"	Swivel	2—auger & rotor	2	no	\$393
	Self-prop.	5½	25"	Swivel	2—auger & rotor	1	yes	\$395
BOLENS	Self-prop.	3	18"	Swivel	1—rotor	1	no	\$160
ESKA	Self-prop.	4	20"	Swivel	1—rotor	2	no	\$300
	Self-prop.	7	26"	Swivel	1—rotor	2	no	\$495
GRAVELY	Self-prop.	6.6	26"	Swivel	2—auger & rotor	2	yes—2 speeds	\$528
JACOBSEN	Hand push	2½	16"	Fixed	1—rotor	none	no	\$130
	Self-prop.	3½	20"	Swivel	1—auger	1	no	\$210
JARI	Hand push	2	15"	Fixed	1—rotor	none	no	\$99
	Self-prop.	3	20"	2 way	1—rotor	1	no	\$190
	Self-prop.	3	20"	Fixed	1—rotor	2	no	\$240
MOTO-MOWER	Hand push	3	15"	2-way	1—rotor	none	no	\$120
	Self-prop.	3½	20"	Swivel	1—rotor	1	no	\$220
RED	Hand push	2½	15"	2-way	1—auger	none	no	\$110
	Self-prop.	3½	20"	Swivel	1—auger	1	no	\$220
SEARS, ROEBUCK	Hand push	2½	15"	2-way	1—auger	none	no	\$90
	Self-prop.	3	18"	2 way	1—rotor	1	no	\$155
	Self-prop.	3	26"	Swivel	1 auger	1	no	\$211
SIMPLICITY	Self-prop.	3½	23"	Swivel	1—auger	1	yes	\$235
	Self-prop.	7¼	36"	Swivel	1—auger	3	yes	\$495
SNOW BIRD	Self-prop.	3	22"	Swivel	2—auger & rotor	1	yes	\$230
	Self-prop.	6	28"	Swivel	2—auger & rotor	1	yes	\$330
SNOW-BOY	Hand push	3	15"	Swivel	1—auger	none	no	\$140
STORM KING	Self-prop.	3	20"	2-way	1—auger	1	no	\$160
TORO	Self-prop.	3	17"	Swivel	1—auger	1	no	\$200

chine for quick sale. I learned a painful lesson from one such shoestring outfit when I tried to buy a blade replacement. There weren't any spare parts because there wasn't any maker. He'd gone out of business.

Moral: Make sure that the blower you pick is backed by a reliable service organization that's likely to be around when you need it—or you may end up nursing an orphan.

Hand push or self-propelled? Cheaper blowers supply power only to the snow-throwing blades—you supply the power to push the machine into the snow. They're light (75 to 100 pounds), have modest power (1½ to 2½ hp.), and are rather flimsily built. They sell for under \$100 on up to \$150. They'll do an adequate job in light snow and on level ground, but you'll have a hard time hand-horsing one through thick stuff.

My love affair with snow blowers really got hot when they added power to the wheels. This is partly because I have 400 feet of driveway and foot paths to clear and live in Wisconsin where winters don't kid around.

Self-propelleds are a different breed. They're bigger, burlier, weigh well over 100 pounds, and have three to six horsepower under their belts. They also tack an extra \$100 to \$200 onto the price tag. There's a reason: While the added power goes partly to drive the wheels, it also means more authority in the snow-throwing department.

Self-pushing machines are reported to be outselling hand pushed ones by six to one—evidence that the snow-shoveling public is willing to pay the price for no-sweat performance. Many machines are bought with one eye on the newspaper

[Continued on page 204]

10-Million-Ton Plug for the Colorado River

Super-rigs and savvy speed construction of 70-story-high Glen Canyon Dam, biggest concrete-pouring job since Grand Coulee

By Henry B. Comstock

WHIP up enough concrete to pave all four lanes of the Pennsylvania, Ohio, and Indiana turnpikes. Load it into 12-yard buckets and whisk the entire 10 million tons over the world's most spectacular cableway. Then plop it, tier upon tier, into a lonely reach of the Colorado River Canyon. Keep pouring until you've formed an awesome plug that arcs 1,500 feet from cliff to cliff, and 710 feet from bedrock to rim.

That's what they're doing in northern Arizona right now. The plug is the U. S. Bureau of Reclamation's \$326 million Glen Canyon Dam. When it's finished, in 1963, this kestonelike slab will be the second-highest dam in the Western Hemisphere. Only Hoover Dam will top it—by a scant 16 feet.

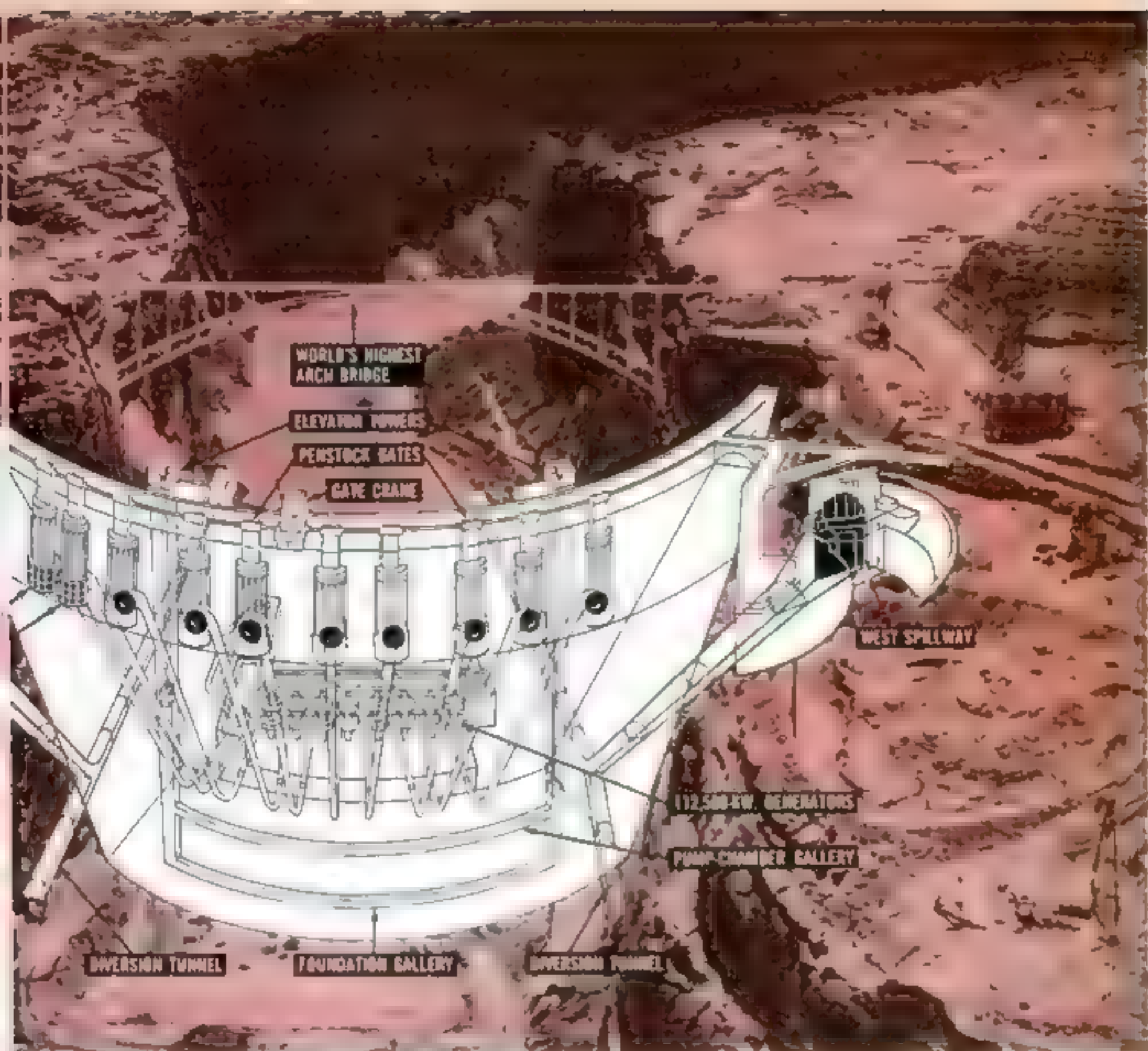
Water in the bank. Like Hoover, 370 miles downstream, Glen Canyon will bridle the rampaging Colorado River. But its purpose will be more sophisticated than that of the older dam, which brought irrigation and power to the lower Colorado basin. Here's the setup:



PHANTOM VIEW shows dam from upstream. Two 41-foot-diameter diversion tunnels will tie into spillway bores to valve water to the lower basin in times of drought. Normally, all flow will be through the river outlets and penstocks (sluices regulating water flow).

ABOVE GLEN CANYON, the upper Colorado Basin will be used mainly to store water for irrigation and industrial use. Only two dams—one of them Flaming Gorge—will generate power. The Navaho dam is an earth-fill job.





Above Glen Canyon lies a wasteland almost as large as New England. Water is plentiful there, but it tumbles erratically from mountain snowfields and thunderclouds into thousands of miles of inaccessible chasms. Above them the desert floor is as parched as a hardrock driller before pay day.

Curiously, Glen Canyon Dam won't change this. The task of trapping water to irrigate the upper Colorado basin will be handled by 10 other new dams to the north. Collectively they'll open a third of a million acres for farming.

That's fine. But what happens to the lower Colorado basin? Surveys show that in wet years there'll be more than enough water left to supply all downstream needs. In dry years there won't be.

Glen Canyon will solve the problem. It will check the

FIRST RIGS INTO CANYON were lowered by 50-ton-capacity cableways that stretch 2,000 feet between towers.

CONTINUED

Glen Canyon will act as a regulating valve— metering water to the lower Colorado basin

upper basin's runoff and push it back 186 miles to form America's second-largest man-made lake. Then, acting as a giant regulator valve, it will meter every bit of this water to the lower basin. Its reservoir is so capacious that even in times of extreme drought, business will go on as usual at Hoover and Parker dams to the south.

This doesn't make Glen Canyon an upper-basin cost liability. Its "water meters" will be eight huge turbine-generator sets. Together, they'll send 900,000 kilowatts pulsing through upstream high lines. Peddling this power will go a long way toward paying for the whole complex. The rest of the tab will be picked up by the other 12 dams through the sale of water and lesser amounts of juice.

How it's being built. Apart from brute size, two features make Glen Canyon Dam a spectacular construction job. One is the breakneck pace at which the slab is rising from the river floor. The other is the broad-handed way the stage had to be set before bellowing rigs could get

in with millions of tons of materials and prefab assemblies, then process the raw stuff and lower the whole works to the bottom of the gorge. Here's a sampling of chores the hard hats faced:

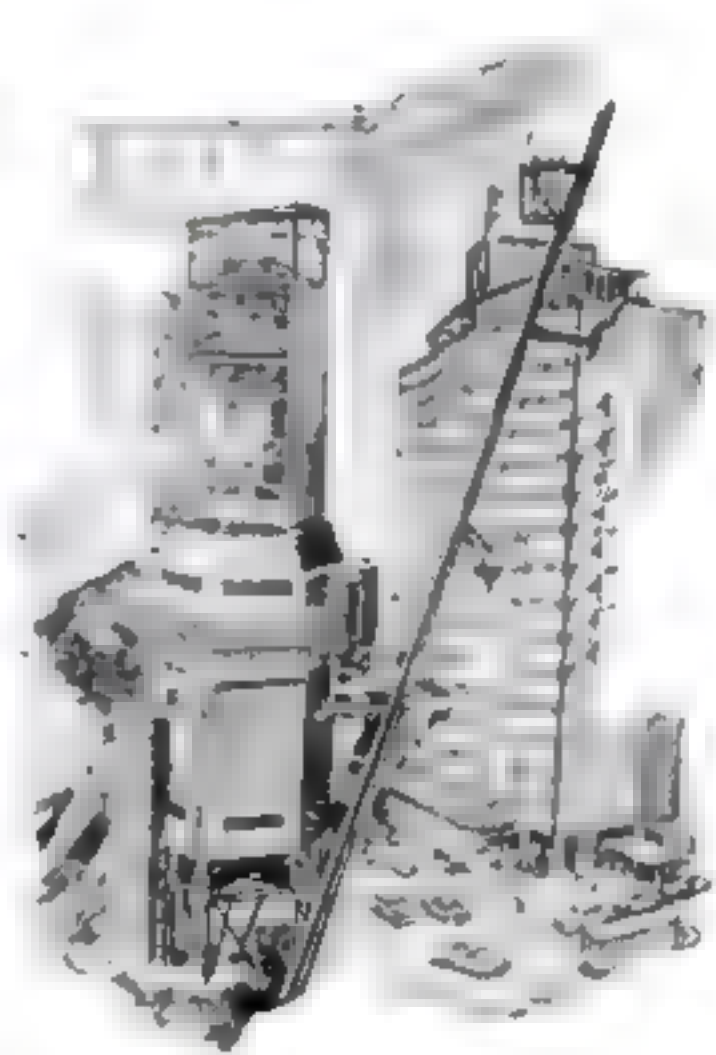
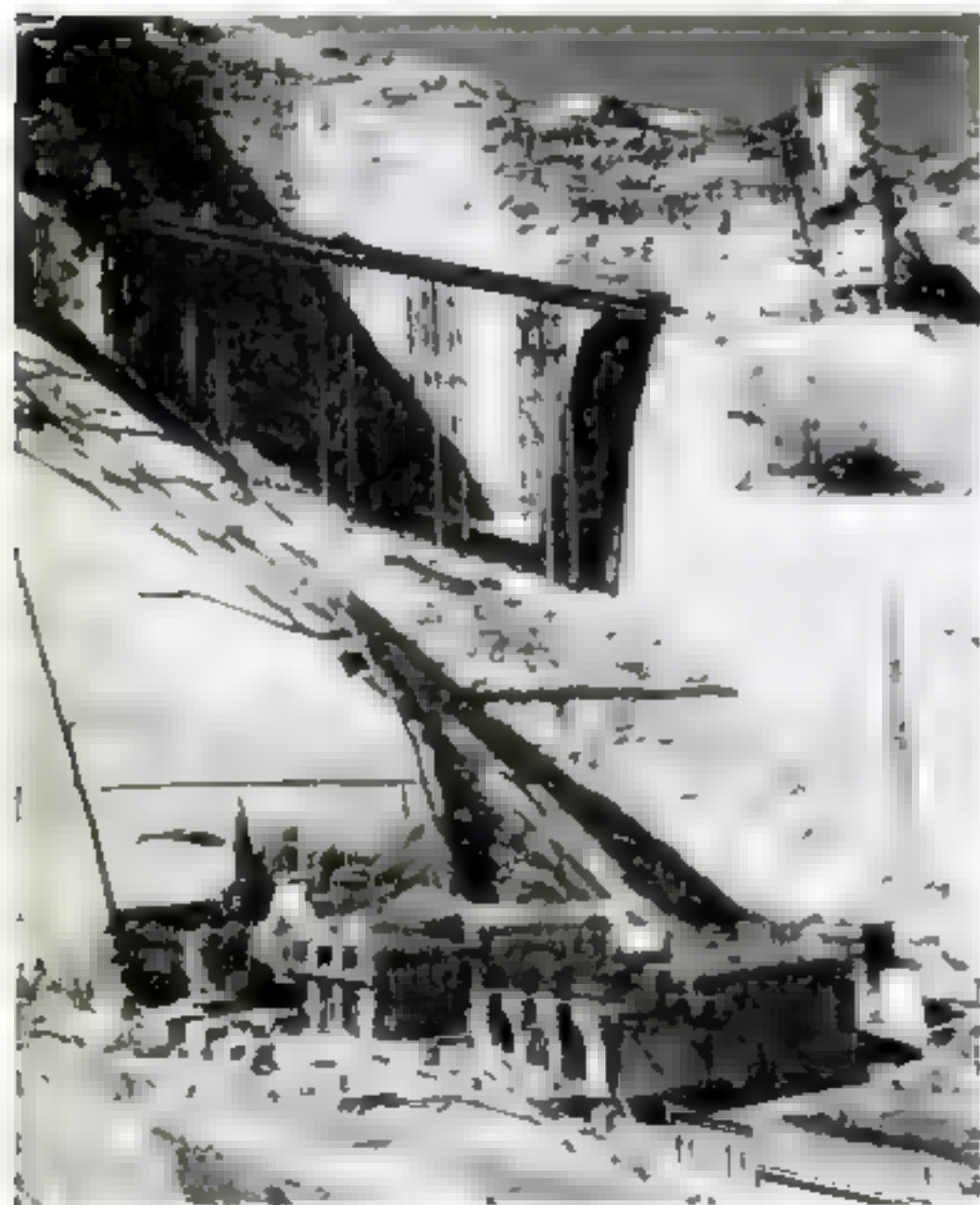
1. Build 100 miles of superhighway, much of it draped over eye-popping cliffs, from the nearest existing road (U. S. 89) to the dam site.

2. Beef up connecting sections of 89 to take the slugging of 60-ton outfits converging on Glen Canyon from distant railheads—the closest at Flagstaff, Ariz., 135 miles south.

3. Spring the world's highest steel arch bridge from one canyon rim to the other, to shrink the highway distance between them from 200 miles to only 1,028 feet. Its deck is 686 feet above the river.

4. Throw three cableways across the chasm, stretching their guts between movable towers nearly 200 feet high. Two of the high lines have a combined capacity of 100 tons—enough to fly-cast the first earth-movers into the hole.

5. Drive a sloping tunnel, just inside



DWARFED BY CANYON WALLS, the 216-foot-high batching plant (far left) is as tall as New York City's newest hotel—the Summit. It was shipped to railhead in 40 freight cars.



PENSTOCK SECTIONS 15 feet in diameter, have a collective weight of 10,000 tons. Steel rods are used to reinforce concrete only in the power-plant section of the dam.

one cliff, two miles from the rim of the river. Daylight it with 18 windows, or "adits," opening on the lower canyon. The tunnel provides a truck route to the base of the dam, as well as dump-off points for mountains of sandstone rubble.

6. Divert the entire Colorado River from the dam site. To do it, two bypassing tunnels had to be drilled. Each is large enough to handle more water than the Niagara River dumps over both the American and Canadian falls. Gaps between the tunnel ends were closed with temporary coffer dams.

7. Place and detonate 1,200 tons of explosives to rip through the canyon floor to bedrock 137 feet below, carve keyways in the cliffs for the ends of the dam, and core out permanent spillways leading to the diversion tunnels.

Operation yo-yo. It took four years to wrap up the preliminaries. Then, a year and a half ago, an electric transfer car spotted a couple of empty tilting-type buckets under the world's biggest cement mixer. This batching plant—taller than the highest building in Salt Lake City—plumped 24 tons of concrete into each container. Then the dinkey wheeled the load over a trestle and transferred half of it to a waiting cable bucket.

From a control booth at the far end of the trestle, an operator had already jockeyed one of the overhead cableways to a point directly above the dam's first



HUGE CRANES IN THE CANYON relieve cableways of many chores. Materials and supplies reach the river by a service-road tunnel carved inside one cliff from top to bottom.

pouring site. This was a touchy maneuver, for the anchor towers on both rims had to be trundled along their 910-foot tracks at the same speed. If one of them got ahead of the other, the four-inch-diameter gut between them would part like a cobweb.

Closed-circuit TV gave the cableman an assist. On one tower was a camera with a 20-inch telescopic lens. On the other, a 16-foot-high fluorescent light tube served as a target. As long as its image stayed on a screen in the control booth, the towers weren't drifting out of step.

Deftly, the cable operator lifted Glen Canyon's first bucket of "mud," trolleyed it halfway across the gorge. Then he dropped it, like a high-speed elevator, practically into the arms of a signalman, or "bellboy," 900 feet below.

Ever since that June day in 1960, buckets have been yo-yoing in and out of the hole at 90-second intervals.

Mixing five million yards of concrete. To keep the concrete churning, a tandem-hopper rig roars over Glen Canyon Bridge with 28 tons of cement every 33 minutes around the clock. The dry stuff comes from a plant 188 miles to the south. This means that when the last of three million barrels is wheeled in, a fleet of 20 such outfits will have traveled a distance equal to 30 trips to the moon.

A second highway fleet works 110 miles

[Continued on page 210]



NYLON ROLLERS spin independently on two close-fitting 14-foot tracks that rotate around engine (at rear) and under seat. Snow Bunny takes snow, ice, rough or swampy ground in its stride, and floats on water. Its hull is watertight.



"SHOVEL HANDLE" moves right or left to engage turning system, forward to advance, back to reverse. Three-speed gear-shift is at left of driver's seat. Pull-accelerator is in handle frame, push-clutch behind it, the starter key in front.

Snow Bunny rides on roller treads

Closely spaced tracks, sprocket-driven around a stainless-steel hull, keep this "go-anywhere" machine from straddling obstructions and getting hung up. Independently mounted nylon rollers resist caking by snow, mud, or oil. For making turns, a combination brake and clutch—called a differentiator—brakes one track while powering the other.

A two-cylinder, 18-hp., air-cooled en-

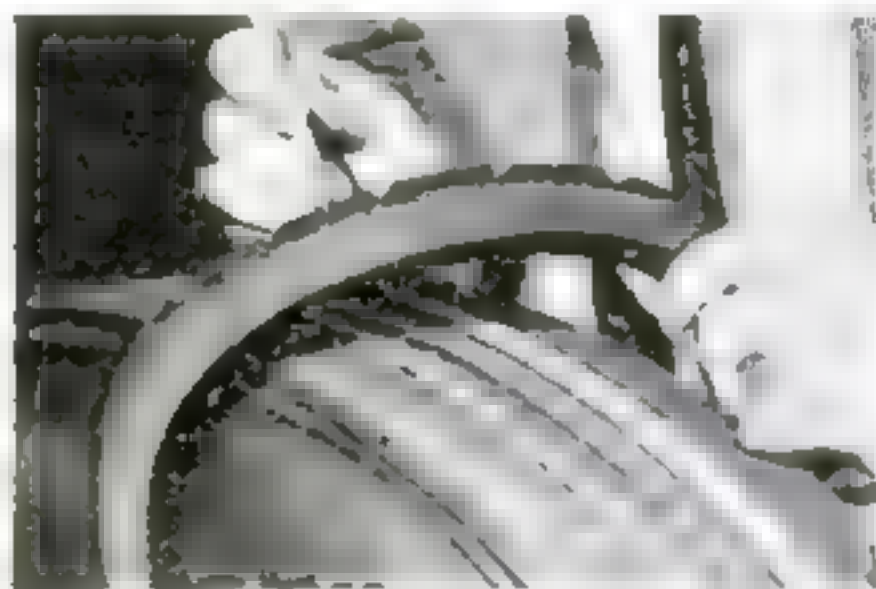
gine, made by an outboard-motor maker, is mounted in the rear with a louver and blower to keep the compartment at 180 degrees. A detector disconnects the wiring system if fumes from the fuel (gasoline or kerosene) leak into the chamber.

The Snow Bunny two-seater shown here costs \$3,200, and there's a utility model for \$2,800. The Dynamech Corp., Danville, Calif., makes it.



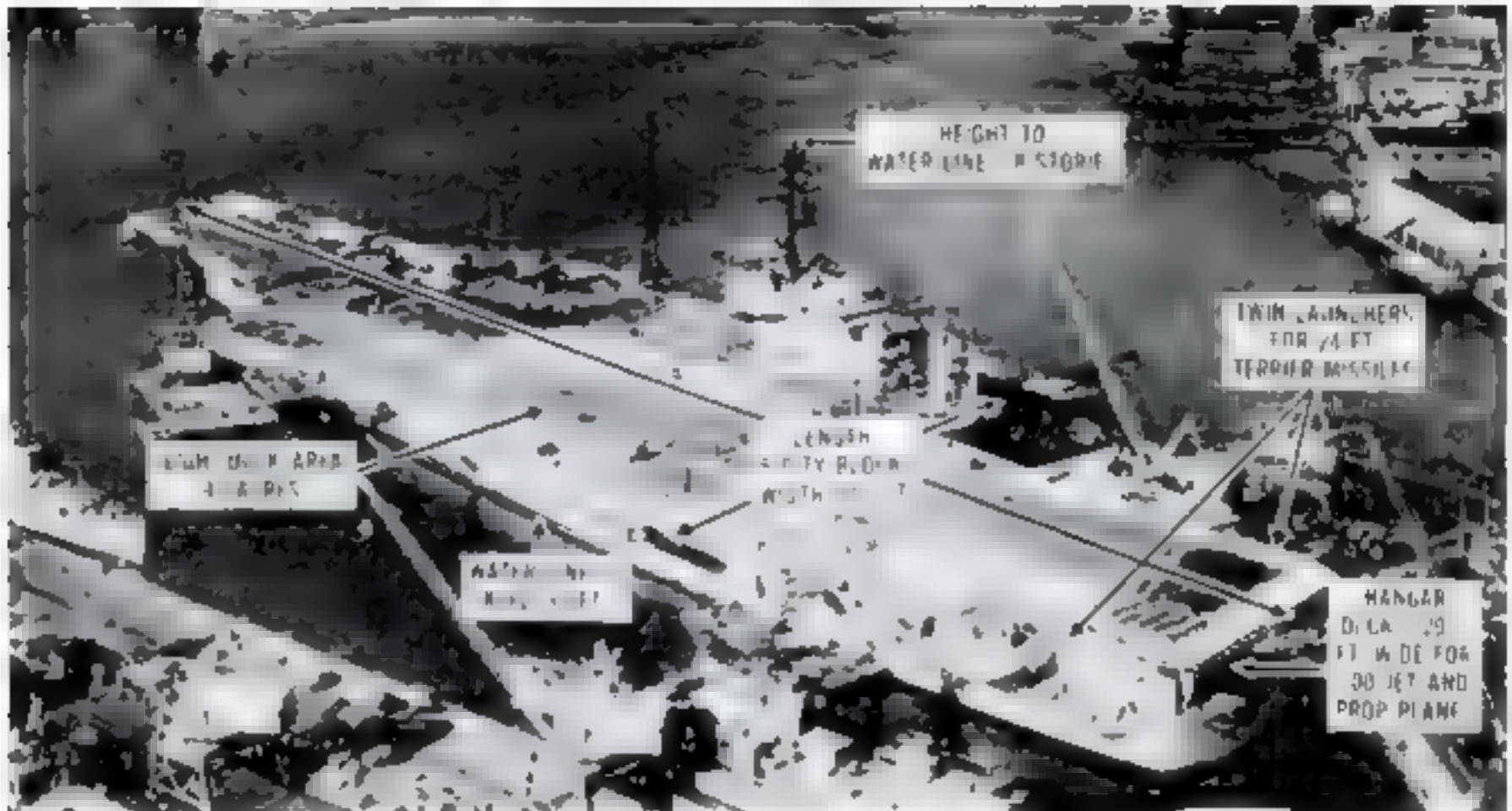
Church of many angles

The new St. Paul's Church in Waltham, London, has a multi-peaked copper-clad timber roof with no internal projecting beams. It is supported by stilt-mounted outer walls built of interlocking concrete blocks perforated to form lattices glazed with antique glass. In the building are also a youth club and social center.



Color-changing tires

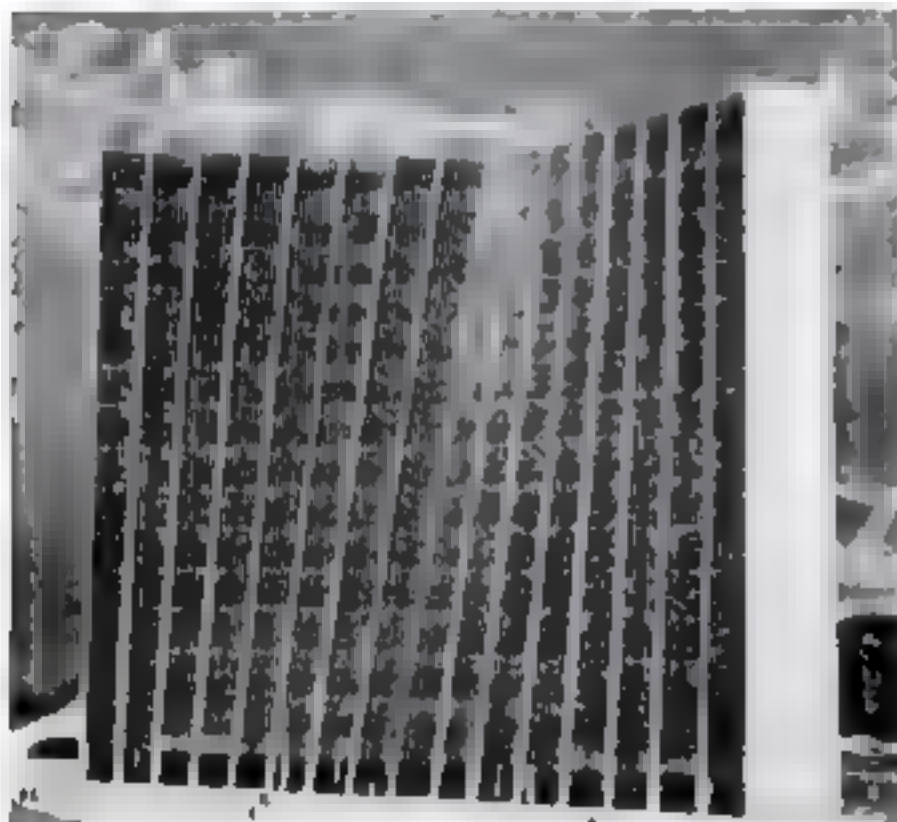
Tires that change color as the tread wears let maintenance crews know at sight when an airliner tire should be changed and retreaded. Red, green, or orange rubber worked into the whole undertread area shows up—a visual danger signal. Goodrich has no plans at present to adapt the idea to automobile tires.



Carrier is world's largest ship

The immense size of the USS Constellation is indicated in this view of the giant carrier at the New York Naval Shipyard in Brooklyn just prior to her recent commissioning. The big ship will carry a crew of 2,700 officers and men, plus 1,400 to fly and service her 100 jet- and prop-driven warplanes. When at sea, a huge evaporator plant will convert

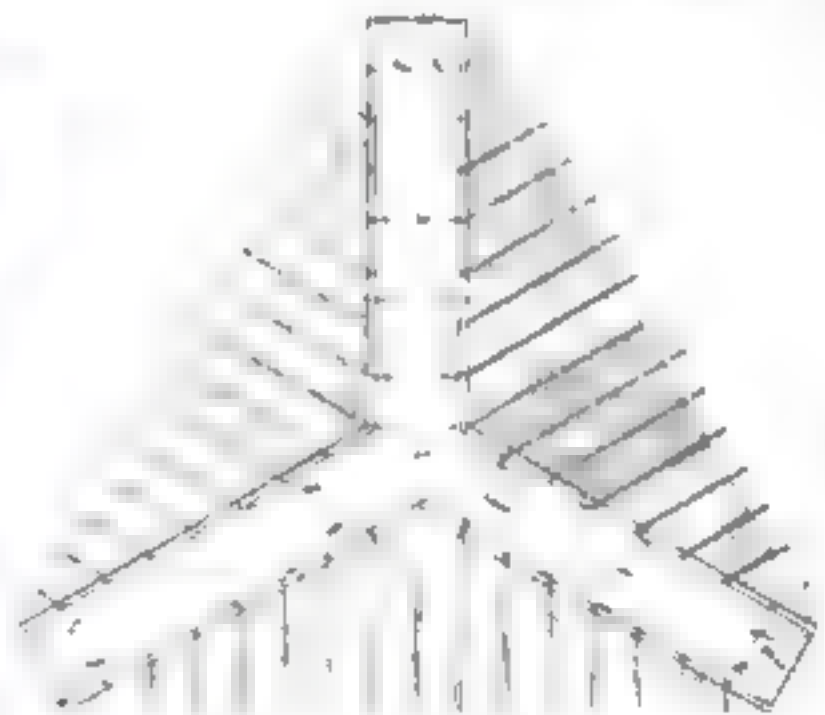
264,000 gallons of sea water a day to fresh water for her needs. The ship has a post office, a laundry, shoe-repair, tailor, and dry-cleaning shops, and three barber shops. For modern comfort, there are foam-rubber mattresses, air conditioning, cushioned chairs, television, dial telephones, and painless dentistry. Construction costs totaled \$200,000,000.



GLASS WALLS of building shown here in architect's drawing slope upward from triangle at base to Y at top, presenting unusual facade.

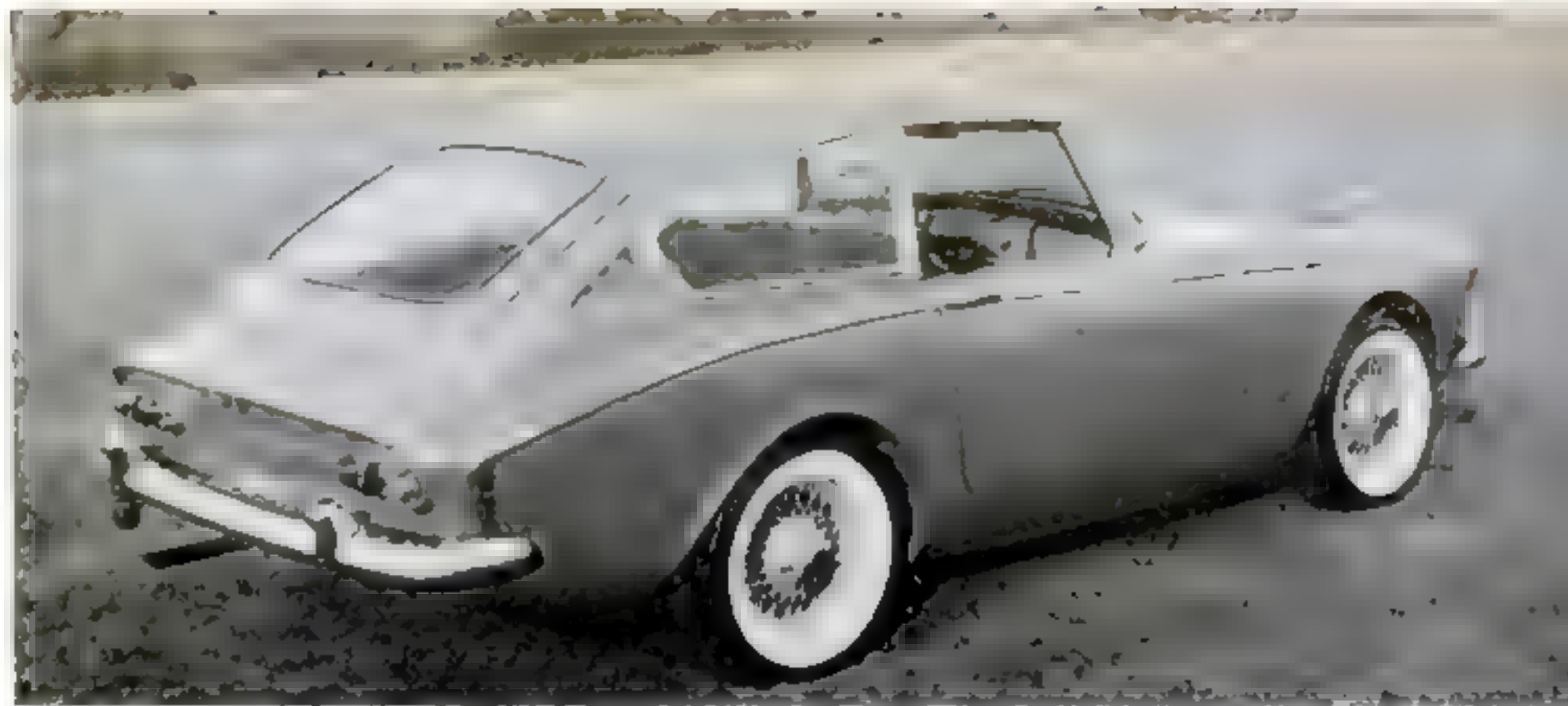
Building is tapered triangle

A 15-story office building planned for the Mexican National Railways changes its shape gradually from an equilateral triangle at the street to a perfect Y at its



PLAN DRAWING shows how triangle-Y building would look from above. Portion shaded shows how building narrows, base to roof, as it rises.

roof. From ground level, its three walls slope inward at varying angles as they rise, making each floor slightly smaller than the one below. Glass paneling resembles a tiled facade. The slanting jamb posts form drains to carry off rain.



Styled for U. S. car buffs, the \$4,000 Sunbeam Harrington Le Mans is a deluxe version of the Sunbeam Alpine, set up for 100-m.p.h. cruising. The rear-window panel is hinged for access to the spacious luggage platform—four feet long when the rear occasional seat is folded flat. Inside are contoured bucket seats, a walnut dash, and wood-rimmed steering wheel. The engine puts out 104 hp. from less than 100 cu. in. Overdrive, heater, wire wheels are standard.

What's New in Foreign Cars

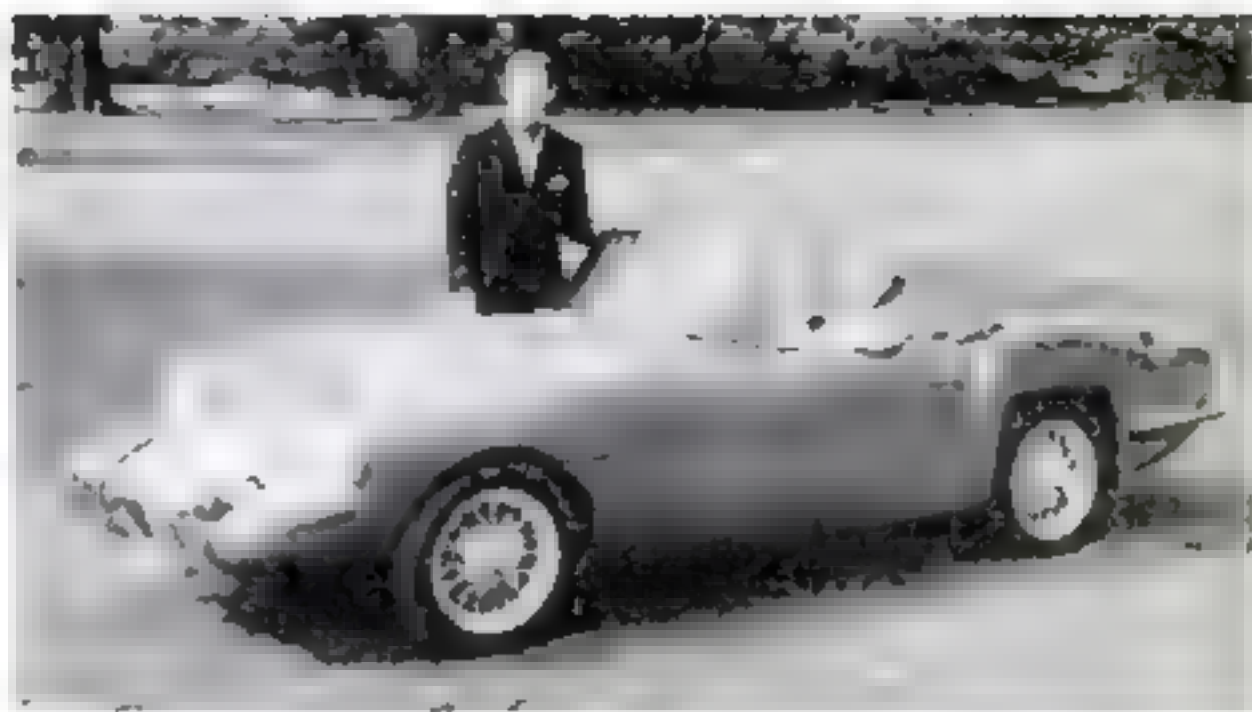


Hillman Super Minx is 3 inches longer and 1½ inches wider than its little sister. A lot roomier inside, it's still a compact outside. Enlarged 97-cu.-in. engine gives 66 hp., and mates to a four-speed close-ratio gearbox, or an automatic. Exterior refinements include wraparound windshield, hooded parking lights (under the headlight brow), and unobtrusive fins. Inside are childproof door locks and anchors for three types of seat belts. Only three chassis grease points remain.



The NSU Prinz 4 admittedly has been inspired by Chevrolet's Corvair. Boxy styling provides space for four adults, rear-mounted engine, and adequate front luggage space. The West German car is 11 feet long and weighs 1,250 pounds. Its air-cooled, two-cylinder 36-hp. engine allows a top speed of 75 m.p.h. and fuel mileage of 40 m.p.g. When heat is desired, the engine pumps warm air forward through a floor duct. Independent suspension is by coil springs front and rear.

A new British entry in the booming sports-car field is the Reliant Sabre. A standard Ford Consul engine propels the streamlined, plastic two-seater body at 100 m.p.h. The electric radiator fan is thermostatically controlled to save power at high speed. The four-speed all-synchro gearbox has an anticrash shutter on the gate that prevents "beating" the synchronizers. Front suspension is by leading links; rear axle is



positioned by trailing tubular arms and coil springs. Brakes are 11-inch disks.



Body by Karmann-Ghia transforms stubby Volkswagen 1500 into a slick, beetle-browed coupe with twin fog lights in the snout. Thin roof line and slender pillars give it a glasshouse look. Convertible model's top folds flush with the deck. Front and rear trunk space and a kid-size rear seat are offered. Suspension is independent-torsion bar, like smaller VW's. Car, designed in Italy by Ghia, is built in Germany by Karmann.

Speed and status—for lots of money. It's the Lagonda Rapide, with a 236-hp. engine. It costs nearly \$15,000 in England, where it's made by Aston-Martin. The dual-overhead-cam, 243-cu.-in. six drives through a Borg-Warner automatic transmission. The aluminum-bodied car does 0-100 m.p.h. in 26 seconds and boasts an easy 125-m.p.h. top speed. Independent rear suspension

Rear-engine rival for the Renault Dauphine (also tail-powered) is the Simca 1000. Its 35-hp. engine is canted 15 degrees to make room for a side-mounted radiator. Drive line includes four-speed, fully synchronized transmission and integral differential to swinging half-shafts. Suspension is transverse-leaf in front, semitrailing-arms-with-coils in rear. The four-door sedan is 12½ feet long. Chrysler Corp. will market it in this country.



consists of De Dion axle and transverse torsion bars. Twin heaters are standard.

U.S. crash-programs decisive nuclear weapon:

The Death-

By Martin Mann

THE eeriest weapon is the death ray. It was invented years ago by the science-fiction writers. Now the off-again on-again hydrogen-bomb race is making it come true in a strange form: an atomic weapon that does not blast things apart or burn them up, but just kills people. Buildings, machinery, landscape are not harmed; all life is erased.

This grim weapon is the neutron bomb. The Russian H-tests last fall may have included neutron-bomb experiments. The U.S. has been working on it for years (at the University of California's Lawrence Laboratory, among other places). Influential congressmen are pushing a crash program to perfect and test it.

Official information on the N-bomb is absolutely zero, for good reasons. Some of what you've read about it in the newspapers is uninformed bunk. (One exception: a preliminary report published 17 months ago, in August, 1960, by this magazine.) But plenty of hard facts can be gleaned from Atomic Energy Commission handbooks and Congressional reports. These reliable bits and pieces fit together to reveal this picture:

- It's fairly easy to make a crude N-bomb—lots of deadly atomic rays, comparatively little blast and heat.
- It's difficult to make a pure N-bomb—all death ray and no bang.
- Even a crude N-bomb looks like a very effective weapon against massed armies, but one not so good against industrial centers or deeply dug in defenses at the "hard sites."
- The N-bomb promises the best

counter for attacking missiles—it could neutralize them in space.

Who needs it? The N-bomb is a completely different military tool from the 50- and 100-megaton earthshakers, which might incinerate not just a city but an entire state in a single holocaust. It is a selective and restricted weapon. With it you might "win" a campaign, not merely wreak possible suicidal revenge.

The N-bomb's deadly rays could wipe out every man in an opposing army. Yet their guns, tanks, and trucks would not be damaged. No radioactive fallout would keep the attackers away.

With the N-bomb an offensive force could kill the opposition, then move right in and take over all equipment and territory. The last possibility is the key one, for taking over enemy territory is the real purpose of any battle.

One N-bomb could probably annihilate an army or wipe out the population of a port, leaving its facilities open to the attackers. The official AEC handbook reveals that a very small, old-fashioned atomic bomb (1/20 the power of the one used on Hiroshima in World War II) spews killing rays over an area of about three square miles. Bombs thousands of times more powerful are now standard armaments. However, multiplying the explosive power of a bomb does not necessarily make it a more dangerous death ray—the lethal range of the rays increases slowly, and heat-blast effects increase also. The



Ray Bomb

N-bomb would have to be a new and special type.

There are a couple of other buts. The death rays go through clothing, the steel of tanks, and the walls of buildings to kill people inside. Yet they will not penetrate *everything* (as some partisans of the N-bomb have implied).

The shielding prescribed for a good fallout shelter would also protect against the death rays from an N-bomb. This means that the N-bomb wouldn't even faze one of our Titan ICBM bases. The death rays would not affect the machinery, and the crews would be perfectly safe in their underground blockhouses.

One other strange fact will upset traditional battle tactics. The N-bomb's rays are not instant death, like machine-gun bullets. Troops might feel the rays strike—their skin would itch and tingle. But they would not keel over right away. They might be able to carry on for some time. And knowing that death was inescapable, they might fight back with superhuman strength and daring.

At least one atomic worker has been killed by these death rays (not from a bomb). He was accidentally exposed to 16 times the fatal dose. He went into deep shock within 15 minutes, but came to six hours later, rational and comfortable. He lived for two days after the accident.

The anti-missile bomb. Death rays don't affect ordinary machinery, but they could throw a decisive monkey wrench into one vitally

important piece of machinery: the plutonium detonator in an ICBM warhead. The death rays are neutrons, and neutrons are what make plutonium atoms fission. So the N-bomb could start an ICBM detonator fizzling. These unwanted fissions would not be enough to set off a chain reaction and blow up the warhead prematurely. But they would create heat. The temperature inside the warhead might go up 360 degrees F., according to the calculations of Prof. S. Fred Singer of the University of Maryland. That, Professor Singer thinks, should disable the ICBM. The neutralized missile would not be blasted from the sky; it would continue to target. But its warhead would not explode.

This scheme was checked out in a series of tests back in 1958, and the U.S. missile-killer Zeus may rely on it. Even if Zeus were armed with nothing better than a small, old-fashioned A-bomb, the rays could disable an ICBM a mile away. An efficient N-bomb would multiply that range greatly, for the rays travel far in space, unimpeded by air. (The lack of air is the reason an ordinary bomb explosion is useless against missiles; without air there is no blast effect.)

Invisible killer. The death ray that the military are whooping up is not a new discovery, but simply a stream of neutrons. Your body is full of them. The neutron is one of the fundamental parts inside the atoms of all matter (except one kind of hydrogen)

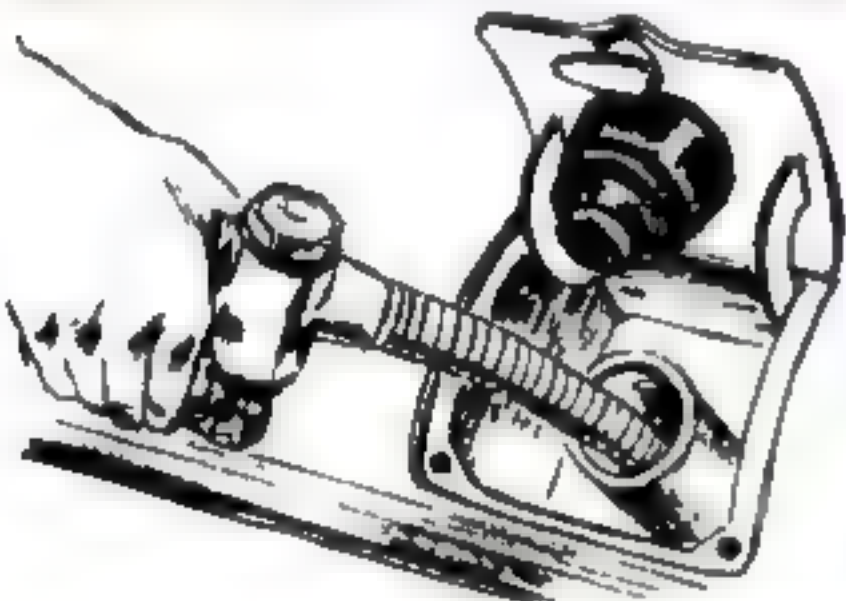
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"I'd like to see them make..."

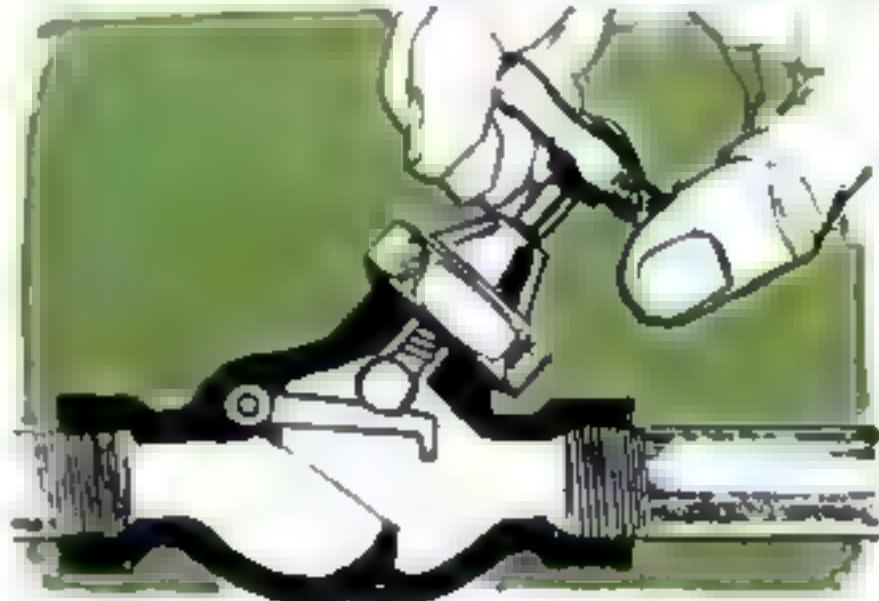


SANDPAPER SHOE SOLES for use in icy weather. They'd have contact adhesive on the back;

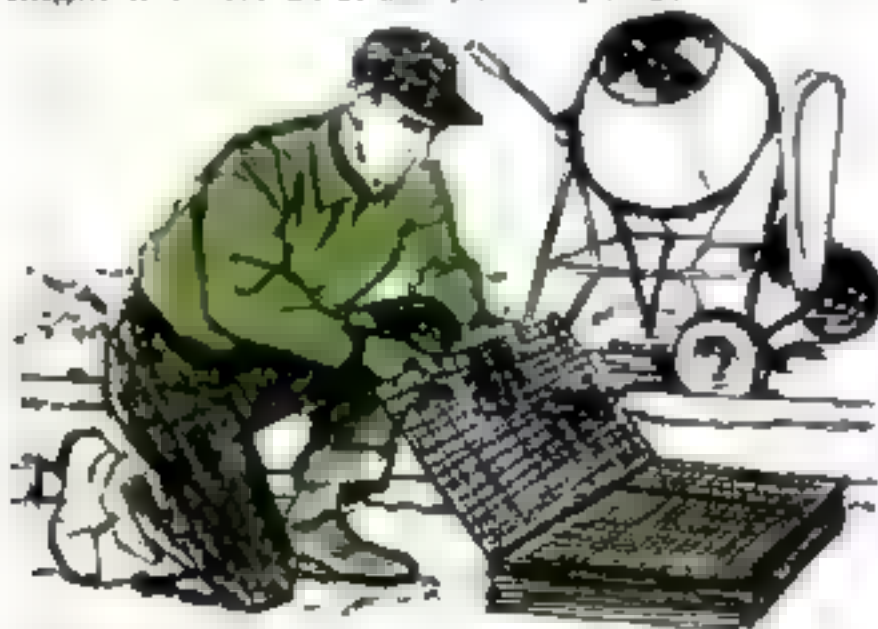
you'd strip them off and discard them when indoors.—*Dr. S. M. Dooreck, Brooklyn, N.Y.*



A COMBINATION DOOR AND CAP for automobile gas tanks to eliminate reaching behind the access door. Soft rubber on an extended spring might do.—*N. G. Kbler, Rome, N.Y.*



A PIPE FITTING that would be a combination check valve and globe valve. Why not a ball knuckle on a stem to mate with a socket on a clapper?—*A. Weigle, Newberry, S.C.*



HINGED STEEL MESH for reinforcing concrete. Then a handyman wouldn't need a truck to haul it and six men to stomp it when pouring a patio.—*Darrell Huff, Pacific Grove, Calif.*



CORDLESS VACUUM CLEANER using batteries that could be recharged on house current. Then you wouldn't be hindered by that dragging cord.—*Ruth Schrader, Clarkburg, Calif.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What's yours? We will pay \$5 for each one published. Please use Government postcards

only. Send to LTG Editor, Popular Science, 355 Lexington Ave., NYC 17. Write your name and address clearly. Contributions cannot be acknowledged or returned.



Retractable-wheel sled is a trailer, too

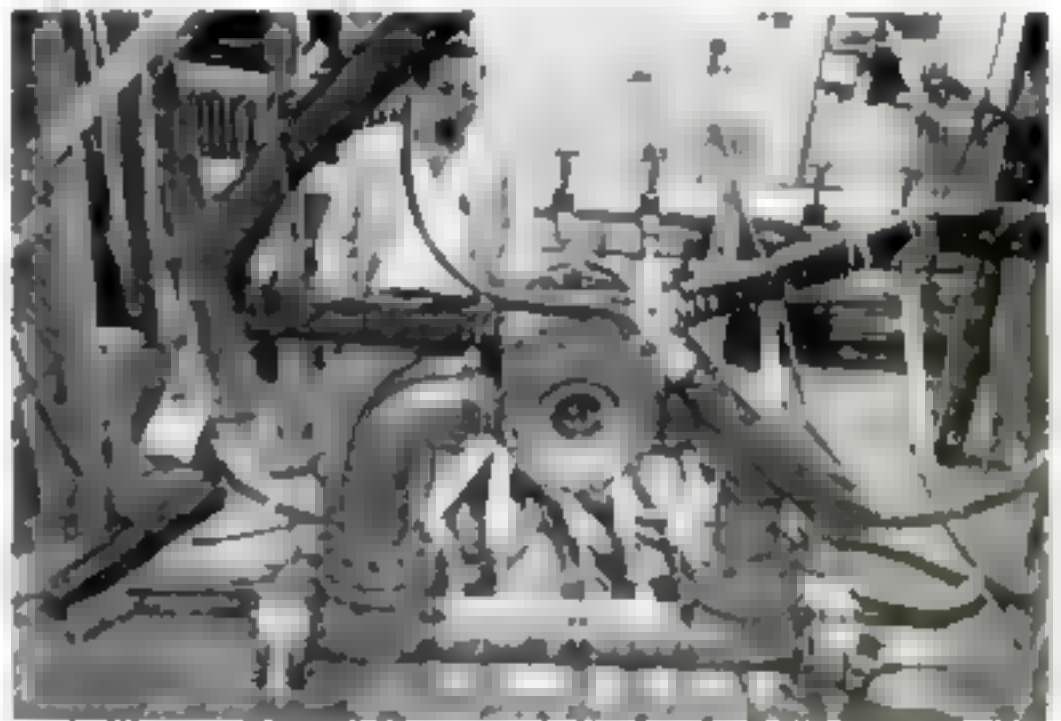
Wheels up and rear propeller whirring, this sled will do 100 m.p.h. if snow conditions are right. Wheels down and front runner removed, it can be towed behind your car. The trailer-sled has a fiber-glass body on a frame of steel tubing and three fiber-glass skis with steel runners.

A 100-hp. Lycoming aircraft engine turns its prop with enough force to take a 25-percent grade. Trail-a-Sled, Inc., Crosby, Minn., makes the four-place model above, with heater, defroster, and a 12-volt electric system, for \$2,570. A two-place version sells for \$1,920.



Raincoat for TV camera

How do you keep a TV camera dry while recording outdoor scenes in the rain? This cameraman in West Berlin uses a waterproof plastic hood. It has holes for the lenses to poke through.



Powerful magnet is water-cooled

A water jacket around a grapefruit-size solenoid magnet handles 320 gallons per minute to carry off heat from 10,000 amperes of current racing through its copper coil. The magnet, invented by Dr. Henry H. Kolm of the M.I.T. National Magnet Laboratory, produces a continuous field of 126,000 gauss, believed to be the highest on record.

It consists of a 135-foot copper ribbon six inches wide at one end and tapering to 1½ inches, interwound, jelly-roll fashion, with insulation. At the center is a small tube where the magnetic field is produced. The device, which consumes 1,800,000 watts, may assist research into scientific fields related to fusion power.

How to handle a Slide Rule: Your Pocket Computing Machine

By Ted
Vincent

WHAT would an extra \$300 a year mean to you? This is fun to think about, but it smacks of work-with-figures (ugh!)—unless you use a slide rule. Then it's a pure pleasure.

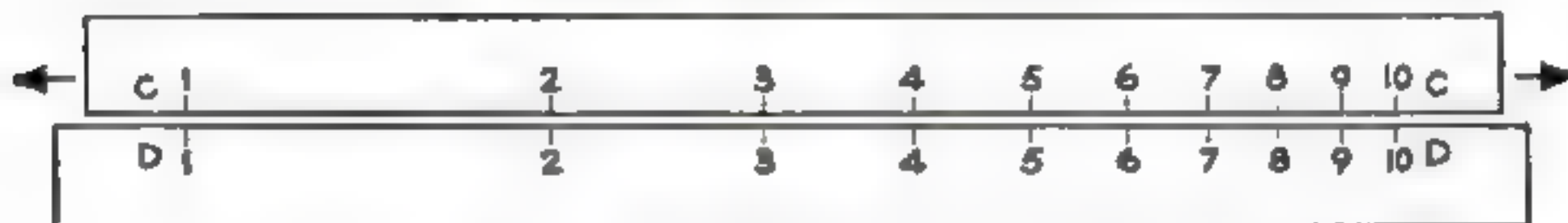
Try the question on an engineer. In about three seconds he draws his pocket slide rule, sets it, and reads the answers as easily as you would read a watch.

"That would be \$25 a month or \$5.77 a week," he says.

"But there's income tax, 22 percent, leaving me 78 percent of the \$300—or \$234."

"So \$300 a year would be \$19.50 a month, or \$4.50 a week."

It really is just that easy with a slide rule—two number



scales that slide together to do your complicated figuring.

With these two scales you can multiply and divide, transform centimeters into inches, change quantities in a formula without changing the proportions, or dream for hours on end about raises, bonuses, and money for vacations.

In fact, you can do just about any number work on a slide rule except addition or subtraction.

A 10-inch slide rule is as accurate as most of the instruments you use—for example, the scales and protractors used in drafting. A slide-rule answer would thus be as accurate as an answer obtained by drafting-board layout. A wee 6-inch slide rule is *more* accurate than the figures used by contractors in estimating.

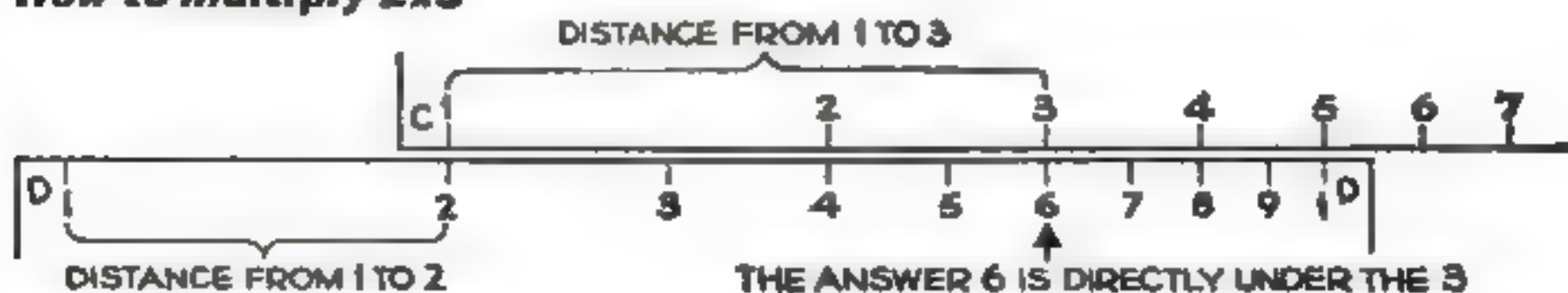
It's all in the spacing. Notice how the numbers squeeze together on the scale. This is done very precisely, so that:

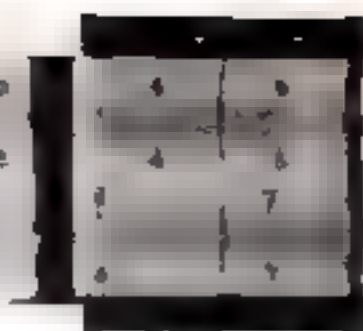
To multiply you add distances.

To divide you subtract distances.

To multiply 2×3 you add the distance from 1 to 2, to the distance from 1 to 3.

How to multiply 2×3

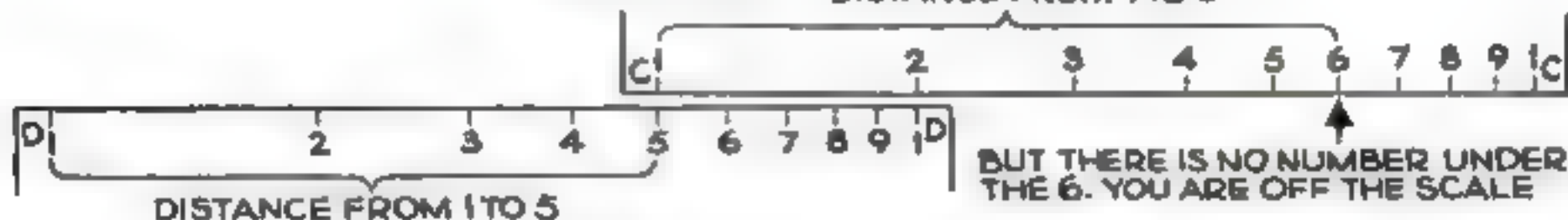




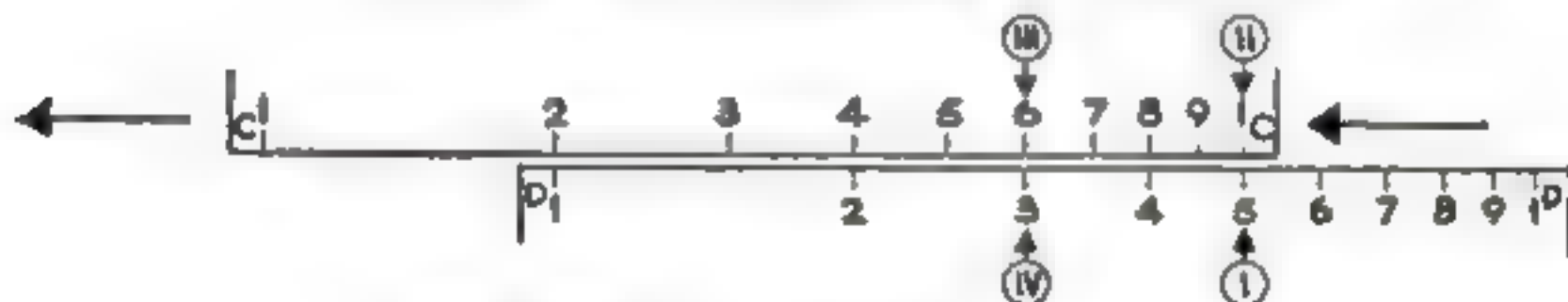
You multiply or divide with scales C, D (see text). Scales A, B (not explained) figure roots.

What happens when you run off the scale?

Here is 5×6 : DISTANCE FROM 1 TO 6



In such cases just slip the upper scale to the left, and set the other 1 over the 5, like this, for 5×6 :



To multiply two numbers:

- I. Locate first number on lower (D) scale.
- II. Put either 1 (on the upper, C scale) over the first number.
- III. Find second number on the upper scale.
- IV. Read the answer under the second number

How to read a slide rule

There are 10 main graduations.

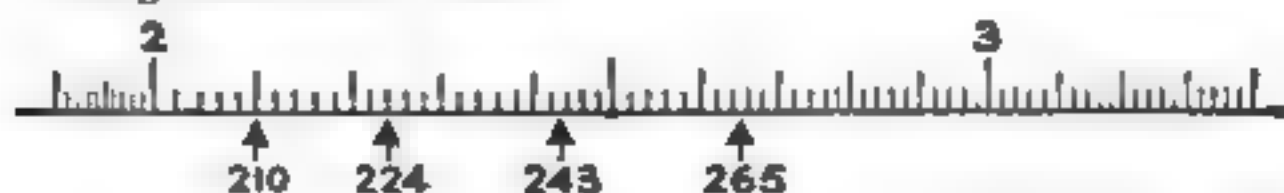


These 10 main graduations give you the first figure of any number. Between the main graduations there are 10 medium graduations.



These medium graduations give you the second figure of any number. In the drawing, I is at 17 (the 7th graduation between 1 and 2). II is at 23. III is at 30.

Now, each medium graduation is also divided into 10 spaces, but there is not room to show a mark at each graduation. Here is an enlarged portion of a scale between main graduations 2 and 3.



How to find the decimal places

Engineers ignore the decimal place when using a slide rule. The trick is to work with the figures only, and ignore the decimal points or extra zeros. Then use common sense to put the decimal point in your answer.

Thus 17×13 gives you the figures 221. If you take a moment to think about it, you can see that it is roughly 20×10 or 200. It could not be 22.1 or 2,210.

How to figure lumber

Lumber prices are quoted by the board foot, or by the hundred or thousand board feet. A board foot is one square foot of lumber 1" thick (but boards that are less than 1" thick are still figured at 1").

To figure board feet, multiply length (in feet) by width (in feet), and ignore thickness of ordinary boards. For thick boards multiply also by the thickness in inches.

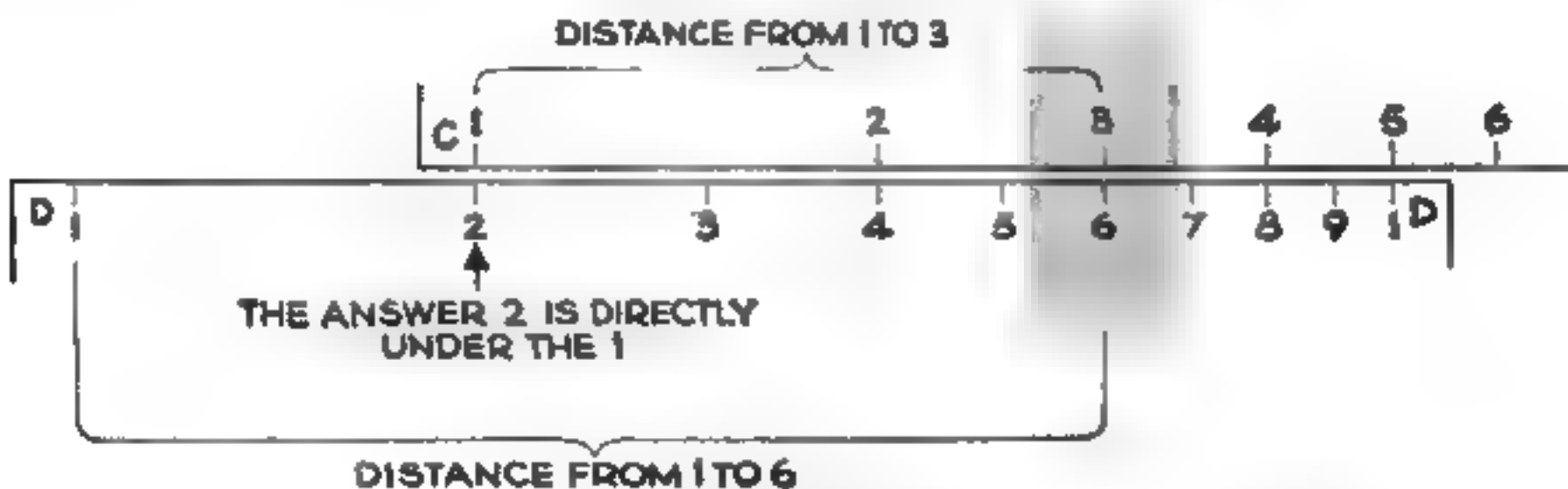
Suppose you have a partition $7\frac{1}{2}$ feet by 14 feet that you plan to panel in knotty pine:



How to divide

This is just the reverse of multiplication. You subtract distances. Thus to divide 6 by 3, subtract the 3 distance from the 6 distance.

To divide one number by a second:

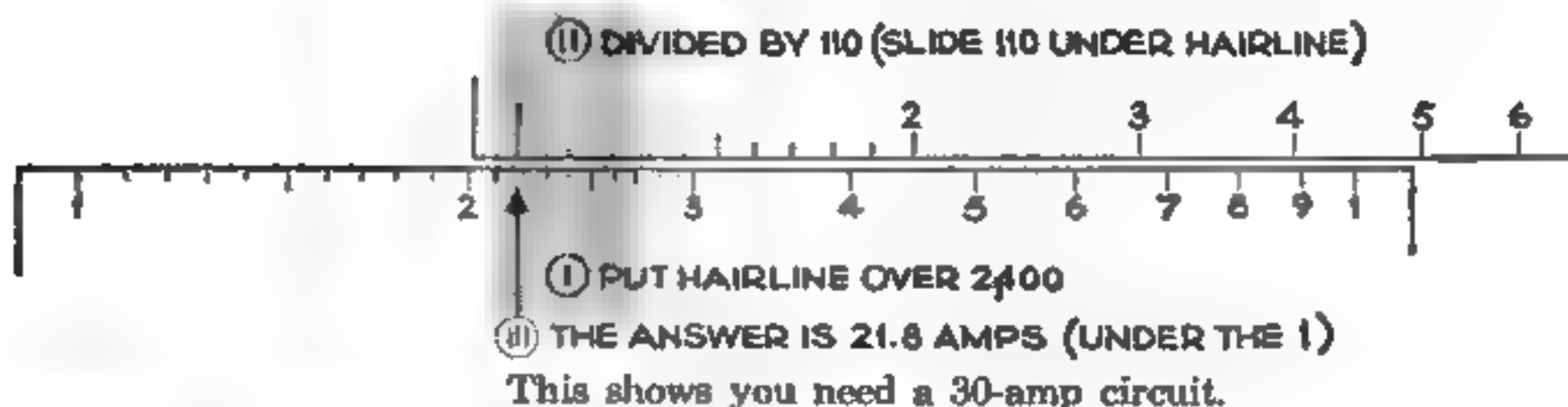


- I. Find first number on lower (D) scale.
- II. Put hairline over first number.
- III. Put second number (C scale) under hairline.
- IV. Read answer on the D scale directly under 1 at either end of the C scale.

How to figure circuit loads

Can you add an electric heater to one of your house circuits? Add wattages of all lights and appliances on the circuit to heater wattage. Divide by 110 to find the amperage. A 1,300 w. heater plus a 800 w. iron plus three 100 w. lamps

give 2,400 w. in the circuit. Amperage will be 2,400 divided by 110:



How to multiply and divide in one setting

Quite often you will find multiplication and division combined in the same problem. For example, in figuring paint you find the area (length \times width) and divide by the manufacturer's square-feet-per-gallon coverage.

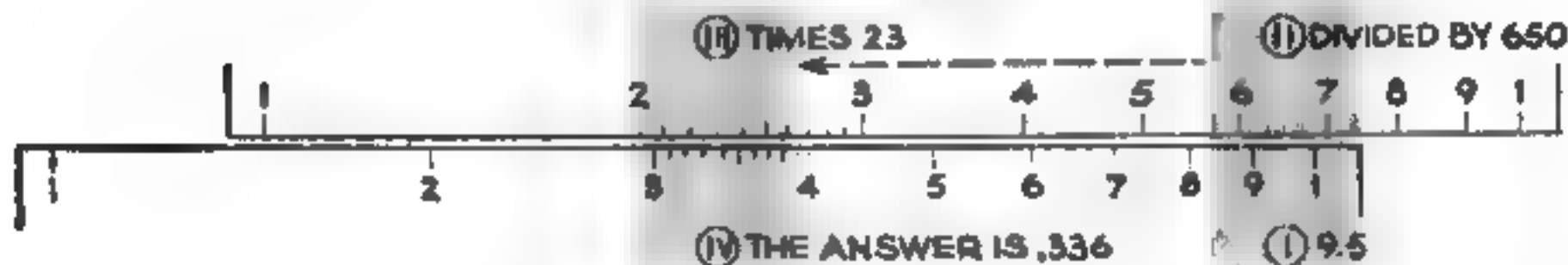
Suppose you want to put one coat of paint, with a coverage of 650 feet per gallon, on a ceiling that is $9\frac{1}{2}$ feet by 23 feet.

Your problem then is $9\frac{1}{2} \times 23 \div 650$. Put such problems in this equivalent form: 9.5×23

$$\frac{9.5 \times 23}{650}$$

You zigzag in these cases:

That is, do the division first, then multiply.



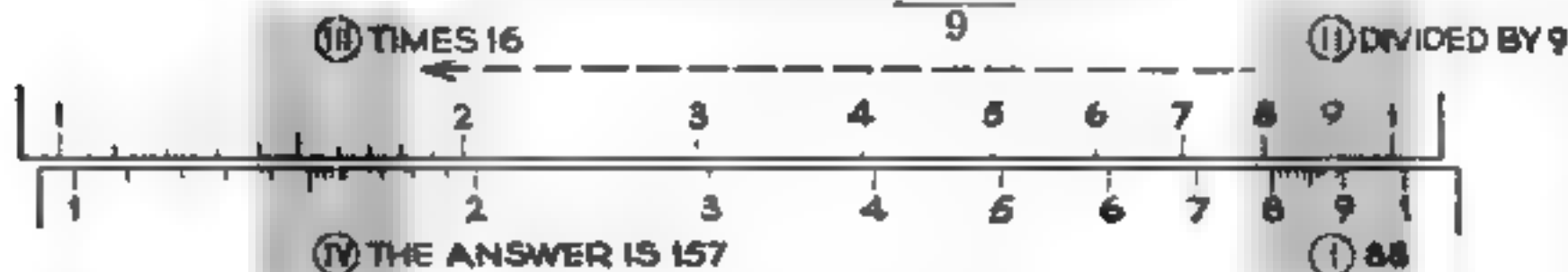
So you need more than a quart but less than a half-gallon of paint. This is all done in one setting.

How to figure tile flooring

For 6-inch-square tiles, multiply the square-foot area of the room by 4 to find how many you'll need.

For 9-inch tiles, multiply the area by $\frac{16}{9}$.

Suppose you are laying 9-inch tiles in a bathroom of 88 sq. ft. You'll need $88 \times \frac{16}{9}$ tiles.



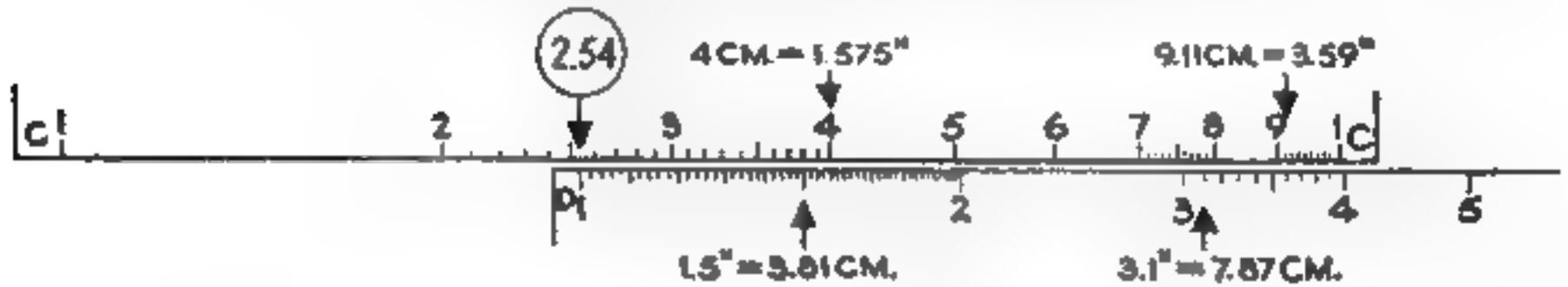
How to change from centimeters to inches or from horsepower to watts

A single setting of the slide rule sometimes gives an enormous amount of information.

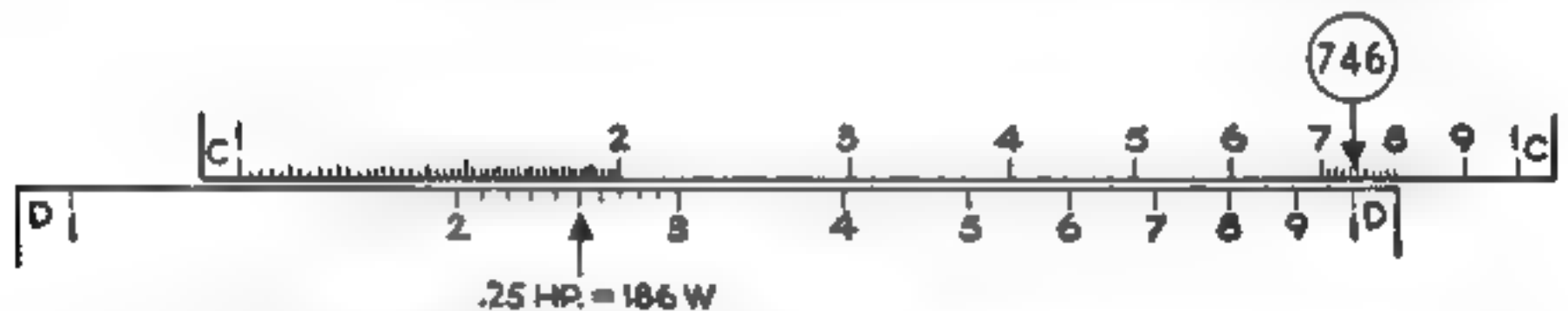
If you know that 1 inch = 2.54 centimeters, you can

easily read off any conversions from inches to centimeters, or vice versa.

Just put 254 on the C scale over the 1 (either end) of the D scale. Then any reading on the C scale shows centimeters directly over the exact equivalent in inches. Thus we can read (with 254 over the left-hand 1):



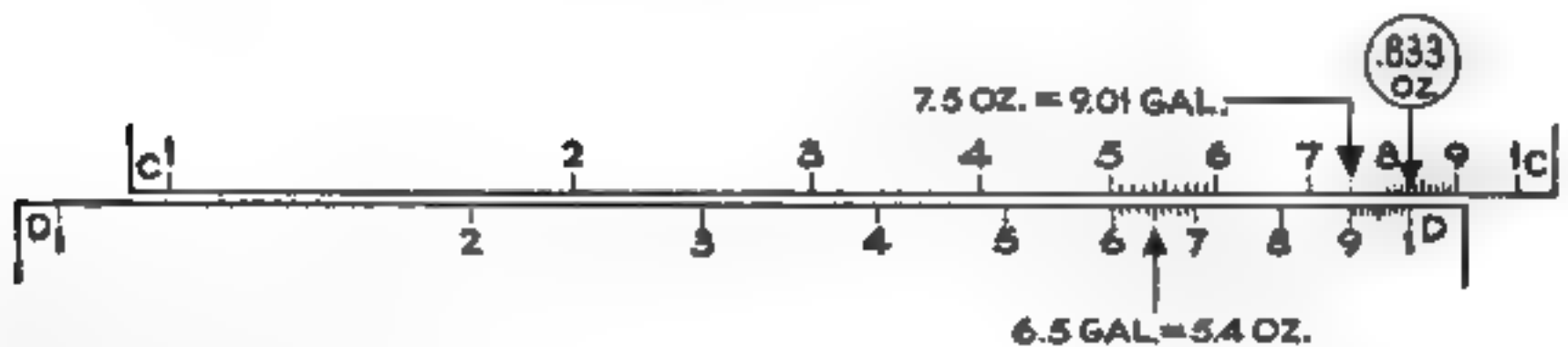
To change from horsepower to watts or vice versa, you need only know that 1 hp. = 746 w. Put 746 over 1, and any value in watts will be over its corresponding value in horsepower. How many watts is a $\frac{1}{4}$ -hp. motor?



How to change quantities in formulas

Suppose your formula calls for 5 teaspoonfuls of insecticide to 1 gallon of water. How many gallons can you make with $7\frac{1}{2}$ fluid ounces of insecticide?

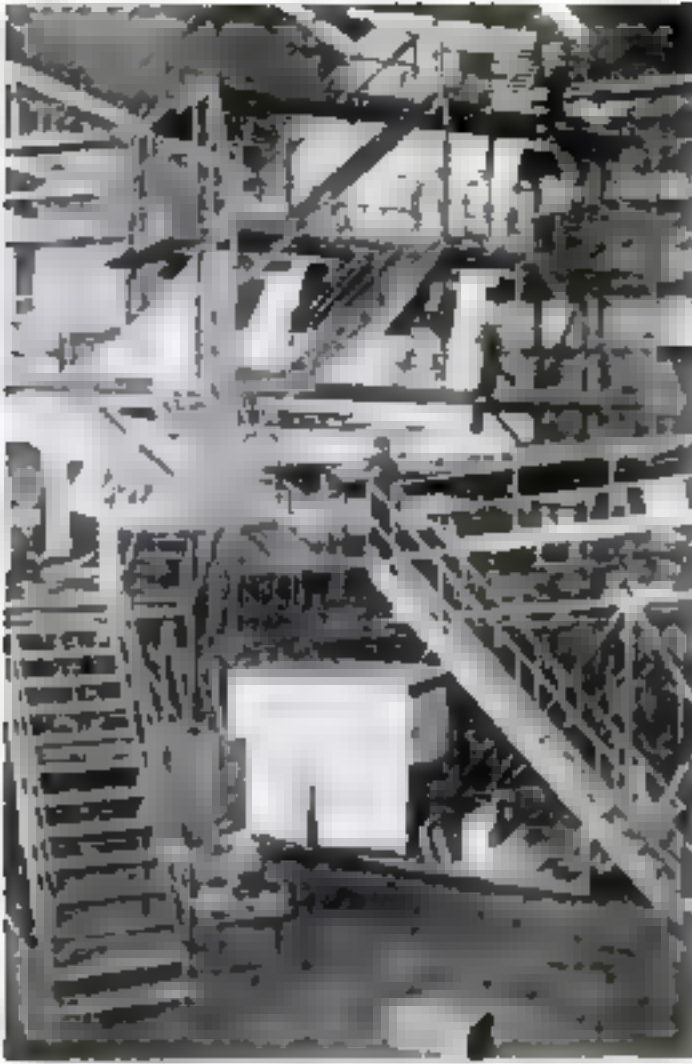
The dictionary tells you that 6 teaspoonfuls are 1 fluid ounce. With 5 teaspoonfuls your proportion is $\frac{5}{6}$ fluid ounces to 1 gallon. A quick division shows that $\frac{5}{6} = .833$, so the proportion is .833 ounces to 1 gallon. That is, put 833 over 1. Now, ounces of insecticide, read on the C scale, are directly over the correct number of gallons.



Buying a slide rule

To get a slide rule that works, you can pay anywhere from less than \$1 up to \$25 or \$30.

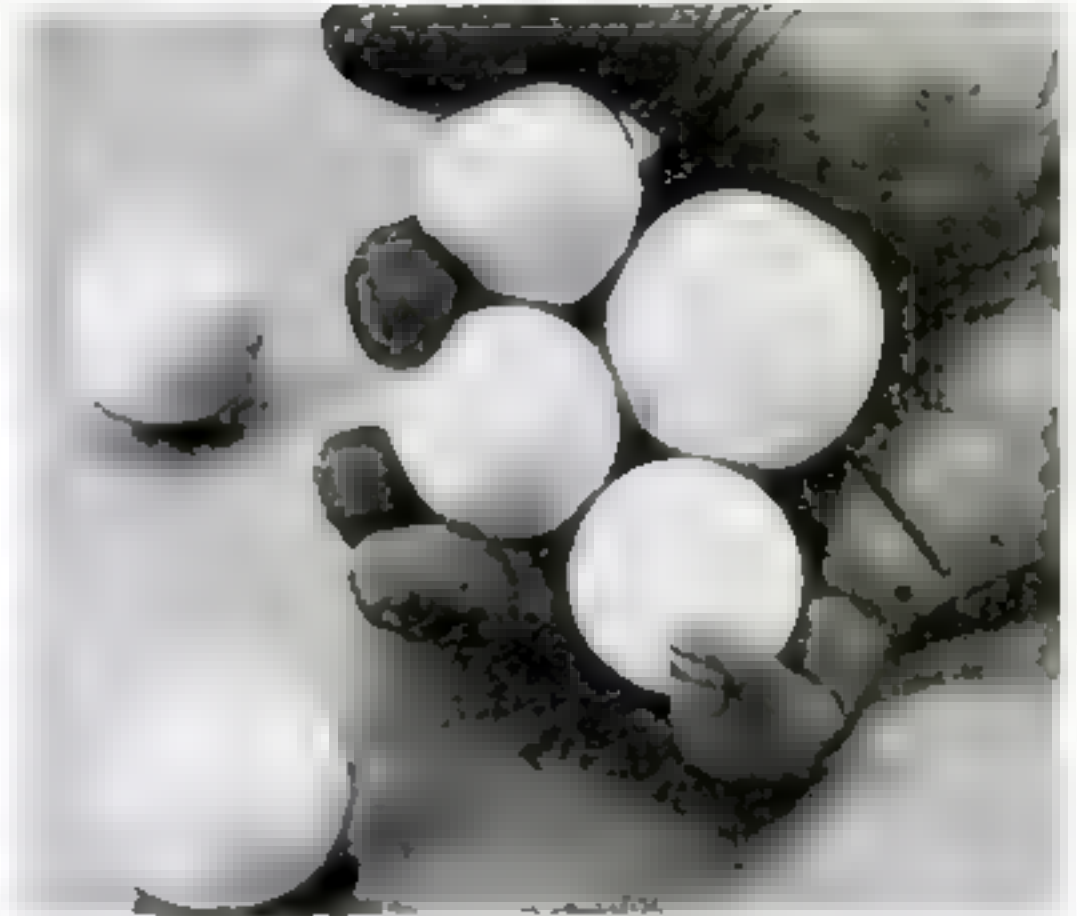
The more expensive rules are machine-engraved for extreme accuracy and legibility, and have a number of different scales that are invaluable in advanced work. For beginners, the new 10" plastic rules, selling for about \$2, are especially good values. To check the adjustment before you buy, line up the left-hand "1"s of the C and D scales as closely as you can. Then see if the right-hand "1"s line up. The hairline should also fall exactly over these vertical lines. ■ ■



Four-story dock for overhauling jets

Giant docks make it easier to overhaul transcontinental jets at Trans World Airlines' Kansas City maintenance base. For quick maneuvering, 26 separate units roll on casters.

The tail section above—two units, four levels—connects with the airframe scaffold. Workmen can service all of a plane without going onto the hangar floor.

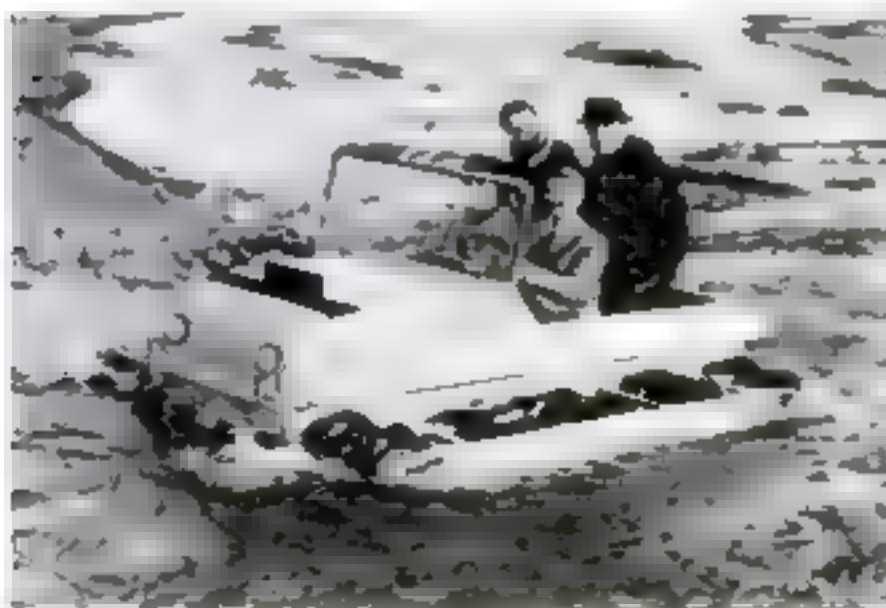


Radioactive glass balls

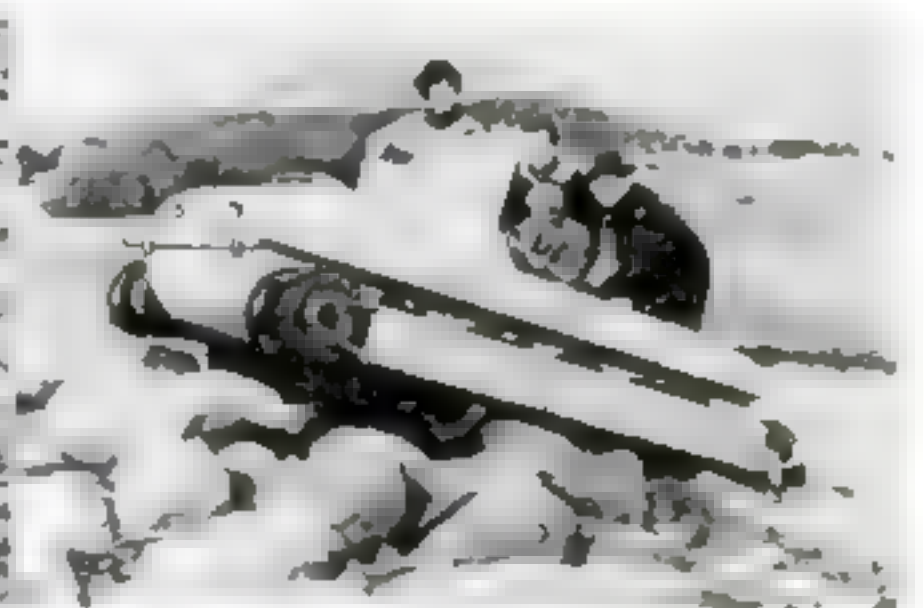
These six little balls may provide the safest method yet of getting rid of radioactive waste. They are made of highly porous ceramic and are used with thousands of others like them for experimental disposal of waste at the AEC's laboratory at Los Alamos, N. Mex.

The globular sponges are soaked in liquid waste from the fission program, absorb it, and are then dried out. The water evaporates, the radioactive particles remain inside. The process is repeated until the balls have taken up all the waste they can hold: about 40 percent by volume.

Then they are fired in a furnace at 2,400 degrees. This fuses them, making glass "bottles" from which radiation can't escape to contaminate air, soil, water, or underground rock strata.



ONE-PIECE PLASTIC BODY is watertight, keeps passengers dry when streams are forded.



FREE-ROLLING FRONT WHEELS help the vehicle to take steep, rocky banks in its stride.

Car rides on 20 wheels

A 20-wheeled amphibian built in Norway lunges over boulders, fords rivers, plows through snow, and can climb a 45-degree grade. The Nobel-Amphibil has

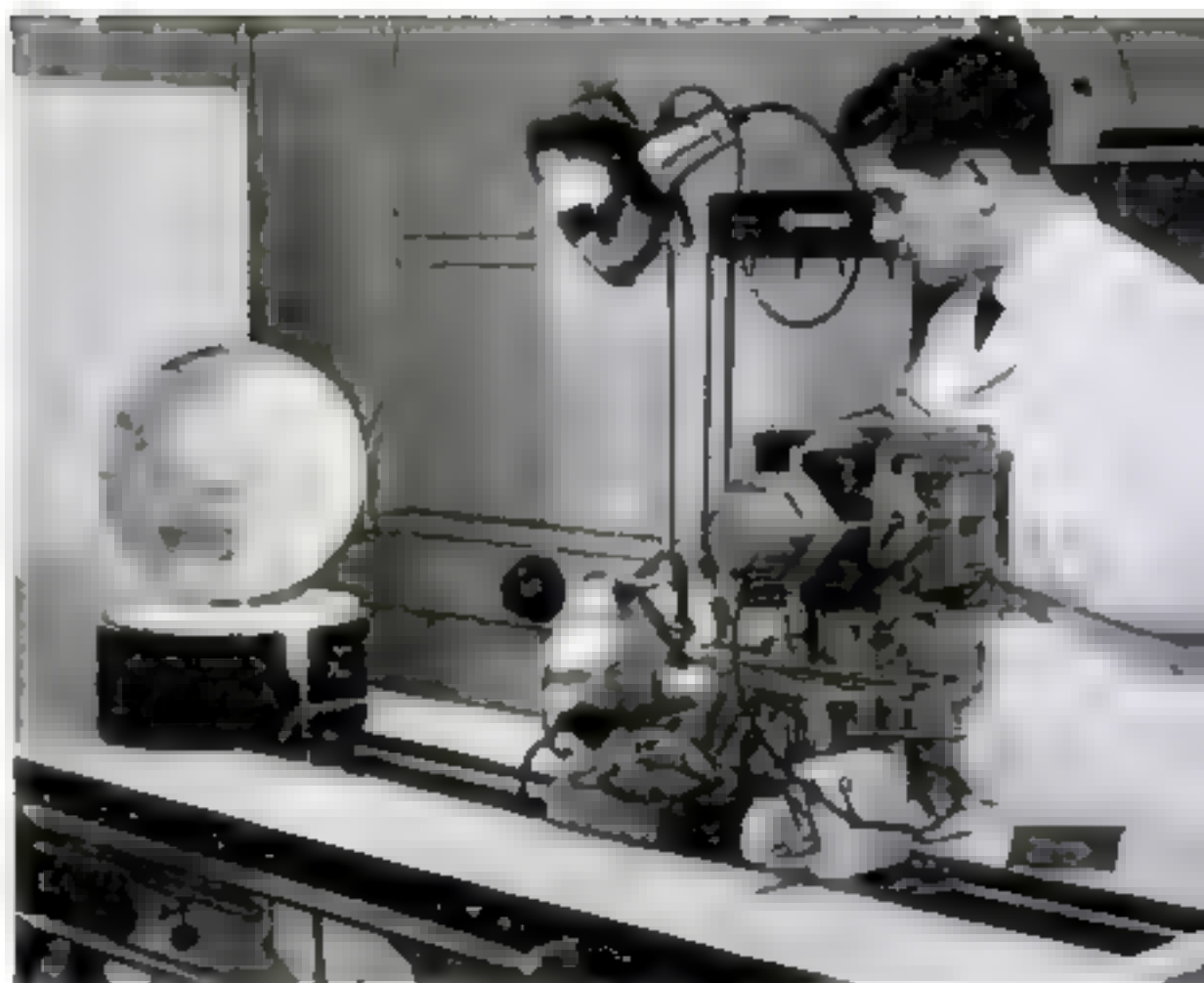
eight double wheels on each side driven by a Volkswagen engine and two small pairs at front that are free rolling and help the machine up the base of obstructions and steep inclines. Top speed is 40 m.p.h., gas mileage 40 to a gallon.

Camera takes rolled-out photos

A new periphery camera takes an all-around picture of solid subjects that looks like an orange skin peeled and laid flat.

The object being photographed is rotated on a turntable. The film holder in the camera traverses in step behind a vertical slit for the exposure. Turntable rotation and film travel take three minutes.

Developed by Shell International in Britain, the camera can be used by police to make rolled-out photos of bullets, of fingerprints on pencils, and of other small items. In industry, it can photograph wear and imperfections on circular parts such as tires and gears.



Globe rotating in front of camera lens . . .



Fenced-in mountainside

How do you keep a mountain from sliding piecemeal onto a highway? Engineers in Colorado prevent rockfalls this way: They bolted steel-mesh drapes—eight-foot widths of woven-wire fencing—on a cliff over the road.

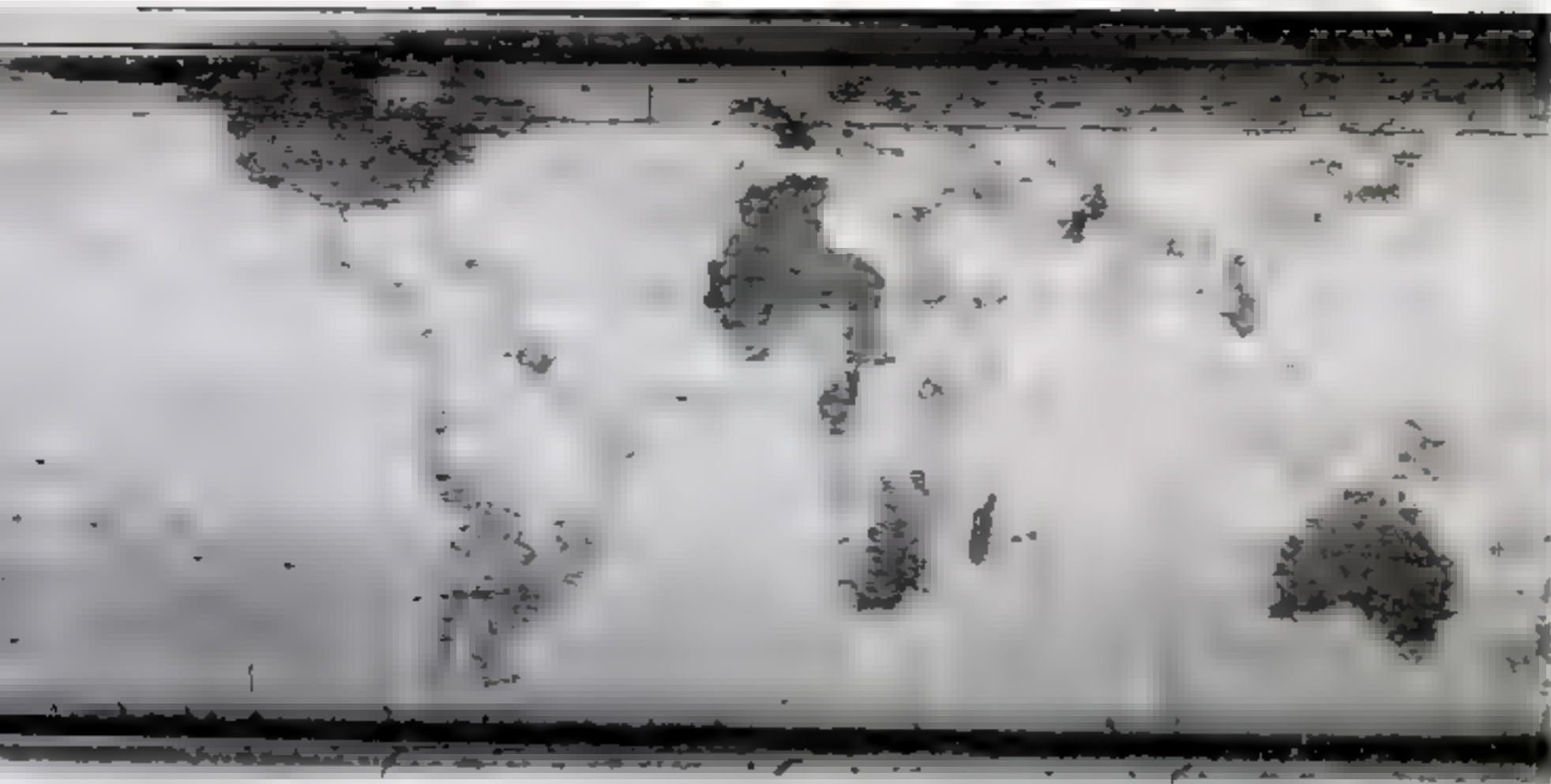
It's on U.S. 6 and 40 at a tunnel approaching the continental divide. Colorado Fuel and Iron installed it.



Medical roll for Navy doctors

A Navy hospital corpsman has come up with a kit to save time spent searching through a doctor's bag at the scene of an accident. Orville George Bizeau designed this canvas first-aid roll to be carried on runs of emergency vehicles.

Unrolled, it lays out in full view 27 different instruments and supplies, all held in individual compartments.



... results in this kind of print: a full-circle flat picture of a map of the world.



Ribbon of dried pears

Dehydrated pears have now been shaped into ribbons, sheets, and chunks the size of cookies in a process developed by the University of California's Department of Food Science and Technology. Made into a thin puree, the juice is poured into trays and dried at 120 degrees for 15 hours.

The strip above has been preserved for a year. It's as chewy as taffy, makes possible a quality achieved only in expensive choice dried fruit.



Ice breaker on rails

When icicles hanging from the roofs and portals of tunnels threatened damage to new automobiles transported on open tri-level freight cars, the Clinchfield Railroad solved the problem quickly.

It built a steel frame on the front of one of its pulpwood-carrying flatcars, then hauled it through all tunnels on the line. The frame breaks off overhanging ice to a height 19¼ feet above the rails and for an ample width of 11¼ feet.

THE men who know cars best are the guys who make them. They're the ones to ask about safety. So POPULAR SCIENCE asked. We invited half a dozen of the auto-manufacturers' safety experts—the men who spe-

Car Men List Their Favorite Safety Devices



cialize in development relating to automotive safety designs—to a round-table discussion. We tossed the ball to them:

Suppose you had \$100 extra to spend on each car—just for safety? Suppose all manufacturers agreed to put \$100 worth of additional safety equipment into every car made? What would you recommend?

The microphone was on the table, the tape recorder rolling. Speaking for the auto makers were Howard Gandelot, Harry Doane, and Light Yost of General Motors; Roy Haeusler of Chrysler; Donald Schrum of Studebaker-Packard; L. H. Nagler of American Motors; John Manikas of Ford. Ready with independent ideas from his own experiments was Prof. James J. Ryan, the University of Minnesota's authority on auto safety. Tossing the questions were Howard Allaway, Frank Rowsome, Hubert Luckett, and Martin Mann of POPULAR SCIENCE. Here's what the tape caught:



Allaway



Luckett



Rowsome



Mann

Manikas: If I, as a motorist, had \$100 extra to spend, well, seat belts would be number one in my book. From what we know today, about padding and so on, I still believe in restraint. Belts might not be best possible restraining device; maybe there would be another one we could come up with. But for the moment belts are the only things that are practical.

Allaway: What else?

Manikas: I would add what is already obtainable—the outside mirror, instrument-panel padding, visor padding. This is exactly what I did when I purchased my new Ford.

Rowsome: How about latches? Would doors be less likely to release under stress if more money were spent on them?

Haeusler: The claim has been made that a quarter of an inch more steel might make a big difference. We have not

seen any instances, even isolated instances, in which our latches have come open by the breaking of latch parts.

Schrum: Any lack of efficiency of the lock is not for the sake of penny saving. We're doing the best we can with the knowledge we have. When we have more knowledge we won't count pennies, we're going to improve the lock.

Doane: The only basis we have for making an improvement is through laboratory and proving-ground tests. But you can't simulate every type of accident. That's where the final information from such organizations as Cornell's Automotive Crash Injury Research comes in. On the latches that went into our 1961 models, the structural strength was increased five to eight times. That's a big improvement. How much it will show up finally in service will be interesting information—but we don't wait for that. As fast as an improvement is indicated by a paper study, and then proved out by lab checks and crash tests, we adopt it.

Gandelot: Let's get to Ryan next. He's an outsider and we'd like to get his viewpoint. Jim, what would you like on a car if you got the manufacturer to spend an extra \$100?

Ryan: First I would want a shock-absorbing bumper like the one I have designed and tested. It projects slightly in front of the car and is mounted on hydraulic cylinders that absorb impact energy. Then we have to use automatic seat belts. I invented a kind you pull out and put on, and when you release them, they go to the back of the seat. They're on little reels to retract them when not in use.

Gandelot: With these on, you can move anywhere you like? There's no restriction whatever? And the belt rolls up when you get out of the car?

Ryan: Yes, you just unflip it and it goes to the back of the seat. Yet it locks rigidly on impact.

Gandelot: And when a person gets in again, he doesn't have any obvious reminder to use his belt?

Ryan: He reaches back and puts it on, or else a red light flashes when he turns the ignition key.

Manikas: The main purpose of these retracting seat belts is just a neater installation?

Ryan: Oh, no. People would wear these belts. There's no restriction or soiling. That's the difference.

Rowsome: There may be a point here. In my household, the female objection is that the belts are dirty. This might be an answer.

Ryan: Seat belts always need adjustment. These are automatically adjusted—you can move around on the seat. It's a means of getting people to wear seat belts, because all the objectionable features are eliminated.

Mann: Anything more?

Ryan: A big pad on the steering post. I don't want a recess in the wheel. I want a pad, a big pad. It's a wonderful thing to be held with a seat belt and to go forward on a steering wheel with a large pad. I need hydraulic bumpers, seat belts that people will use, and a pad on the steering post. What happens to people in accidents dictates these requirements.

Mann: Mr. Gandelot has been containing himself with his list of \$100 worth of safety.

Gandelot: First I would put on a windshield washer.



Equipment that helps a driver prevent accidents is just as important as protection in event of accident . . . if he doesn't have any accident, he doesn't need protection.—Howard Gandelot, GM



The padded center for a steering wheel has a great deal of merit. It distributes impact over a wider area before the driver moves very far.—Lawrence Nagler, American Motors



From what we know today, I still believe in restraint. Belts might not be the best restraining device; but for the moment belts are the only things practical.—John Manikas, Ford

Auto engineers urge wider use of safety

Yost: Very definitely.

Gandelot: But if you live in Arizona or a lot of areas where it never rains, why the dickens do you want to impose a windshield washer on a car buyer when he's never going to use it?

Donne: It takes off bugs, don't forget.

Gandelot: You see what we're up against. That's why we keep it optional. Next I would put on an outside mirror, a remotely controlled mirror. I would put on automatic headlight control. You protect the other driver and, in turn, protect yourself because this beam-switching device never forgets. I believe in equipment that helps the driver to prevent accidents. It's just as important as protection in the event of accident, if not more so, because if he doesn't have any accident, he doesn't need protection.

Yost: Several of these items aren't normally thought of by the public as safety devices. I'm talking about adjustable seats, your outside mirror that's adjustable from inside, and the windshield washer. Yet they increase visibility and also decrease fatigue on long trips. When you analyze it, you find they're all important.

Mann: Mr. Haeusler, you got \$100 worth?

Haeusler: Probably more than that. It's very difficult to do this for the nebulous consumer. It's much easier for me to decide how I would do it, as a motorist, in buying my car. I would spend the money much as the others have indicated, but going further—the belts, shoulder harness, head rests, cushioning for the instrument panel and the visors, too. These are in the injury-reducing area. Let's class this whole next group as visibility improvers: outside rear-view mirror—a LARGE outside rear-view mirror. It's in a position that I can't reach readily from inside, so I'd use the inside remote control. I want it positioned so that I can keep it under continuous surveillance. If the fellow seven cars up is beginning to have his accident, I want to know right now whether I can move left or right out of trouble. Windshield washers certainly I would have . . . rear-window defroster-defogger . . . And an emergency flasher system.

Mann: The one that flashes both rear lights?

Haeusler: It flashes all four turn signals, front and rear. I'd also want back-up lights on my car. Now I've probably run over the \$100 allowance.

Rowsome: What is the safety value of back-up lights, except in the situation of a numbskull who is backing up on a superhighway to catch a missed turn? Mostly you're maneuvering around your own back yard.

Haeusler: I'm thinking of signals. The back-up lights warn pedestrians and traffic: Here is a car that is in reverse and may be moving.

Allaway: Mr. Schrum hasn't had his turn at the \$100 yet.

Schrum: I would go along with most of the things—outside mirrors, washers, seat belts, padding. There's room for more padding in every car, including ours, which, incidentally, has padding as standard equipment on all instrument panels. There are some things coming up in the future which could be very important. These are the various devices for



Several items—adjustable seats, outside mirror, windshield washer—aren't thought of as safety devices. Yet when you analyze it, they're all important.
—Light Yost, GM



I'd be against belts as standard equipment. Every car should have belts—but if we force belts on people, we hamper our efforts to get acceptance of belts.—Roy Haeusler, Chrysler

equipment already available as options

proximity warning and for communications to the car and between cars, which would require the addition of electronic sending and receiving devices as car equipment. These are going to be valuable improvements and will go much beyond the gadgetry we are discussing now.

Haessler: But you're returning to what the manufacturer might decide to put on all cars. I think that's the wrong approach. I'd be against putting even belts on as standard equipment. This may seem to conflict with my statement that I think every car should have belts in every seating position. But if we force belts on people—by legislation or otherwise—we only hamper our efforts to get acceptance of belts. This is shown by our experience within our own companies. We put belts in cars and people get their backs up. They show how contrary they can be and how they don't have to have this thing shoved down their throats.

Rowson: A distinction needs to be made here between active safety mechanisms—things that require cooperation from the car users—and passive ones, steps that work without participation on the part of the occupants of the car.

Mann: How about more fundamental changes in the automobile? Do suspension systems need reworking?

Haessler: We don't have any basis for believing that changing the suspension would reduce accidents.

Lockett: There has been criticism of handling. Are we getting boulevard ride at the expense of precise handling?

Haessler: We have a car, the Chrysler 300, which is frequently used for hard driving. It has different suspension than our others, one designed for driving at the extreme limit of control. If the typical car were driven like that, then all suspensions should be like that. But the overwhelming number of accidents do not suggest by their nature that they were caused by lack of a sports-car suspension.

Lockett: Can I bring up a new subject? Headlights. There must be a way to make them better.

Doane: They're the best that we know how to make. The head-lamp program is a continuing one. We investigate every reasonable idea that is presented to us. We spend a tremendous amount of money in our own research and engineering on lighting as well as in the investigation of ideas that originate with outsiders. Only a year and a half ago an independent inventor came up with a new scheme for polarized lamps that seemed reasonable. It took approximately \$150,000 to check it out. The proposal was found impracticable.

Allaway: What about other safety devices—collapsible steering mechanisms?

Haessler: It's not the device that's important, but the result. "Collapsible steering mechanism" suggests that you're trying to get additional yield out of the assembly to reduce injury to head and chest. Whether this is done by a telescoping shaft or by actual bending of parts is not important so long as you get the desired moderating effect.

Mann: Do you think a steering mechanism could be designed to reduce chest injuries?



I want a shock-absorbing bumper . . . It projects slightly in front of the car on hydraulic cylinders that absorb energy.—Prof. James Ryan, University of Minnesota



Some things coming in the future—devices for warning and communication between cars—would require receivers. These are going to be valuable.—Donald Schrum, Studebaker-Packard



We drive these automobiles . . . our families drive them. We're concerned with safety—and work in areas that provide the most improvement per dollar of cost.—Harry Doane, GM

[Continued on page 216]



TRAVEL POSITION of brake is at axle height. Sled in front of each rear wheel is held up off road by pivoted arm and hook attached to box mounted ahead of it.

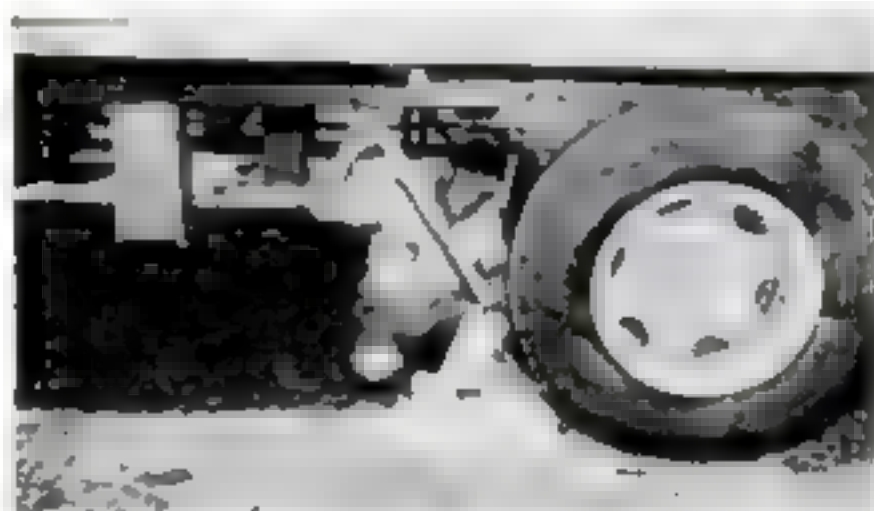
SOLENOID IN BOX releases hook when actuated by switch located in cab on dash. Gravity drops sled to highway.

Sled brakes halt runaway trucks

Emergency brakes that will stop a heavy speeding trailer truck within safe braking distance on a downgrade have been perfected by a veteran Arizona trucker.

The brakes are a pair of steel sleds that drop to the roadway beneath the rear wheels when applied. Ridges on the upper surface prevent swerve, rollers let wheel momentum spend itself without pushing the truck forward. The brakes are held to the bed of the truck by pivoting arms. When not in use, they are kept up off the road by solenoid-controlled hooks. A dash switch releases them.

Kirk Besoyan, the inventor, has organized the Weidner Sales Co. in Phoenix to



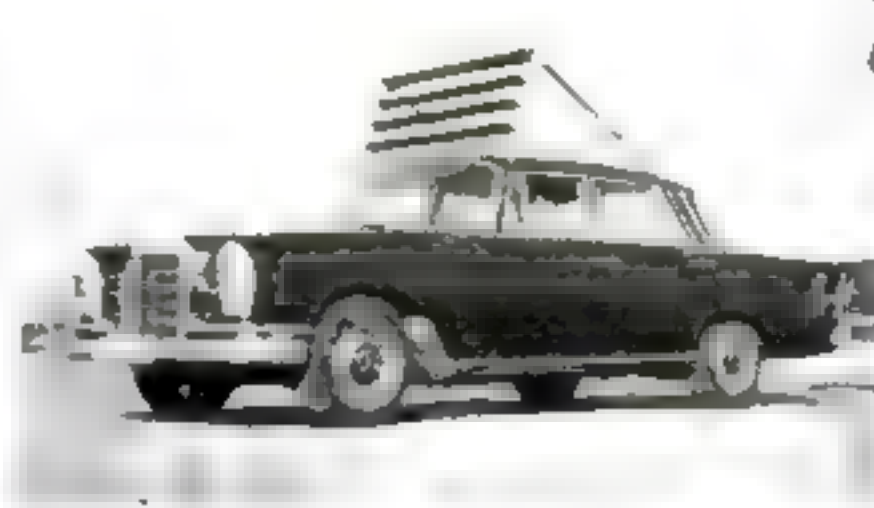
DROPPED TO PAVEMENT, sled traps wheel behind it. Ridges keep wheel from swerving, and small rollers between them use up momentum.

demonstrate and sell his Lifesaver brake. His largest order so far is 10,000 for use on school buses in Illinois.



Barn built out of junk

Fifteen tons of junked "sucker rod" once used in pumps in Oklahoma oil fields form the framework of this 46-by-96-foot barn. Walter Schlosser, Enid, Okla., farmer, shaped the one-inch rod with a jig, welded the jointed ends, and covered the frame with sheet metal. He uses the barn for machinery storage and workshop.

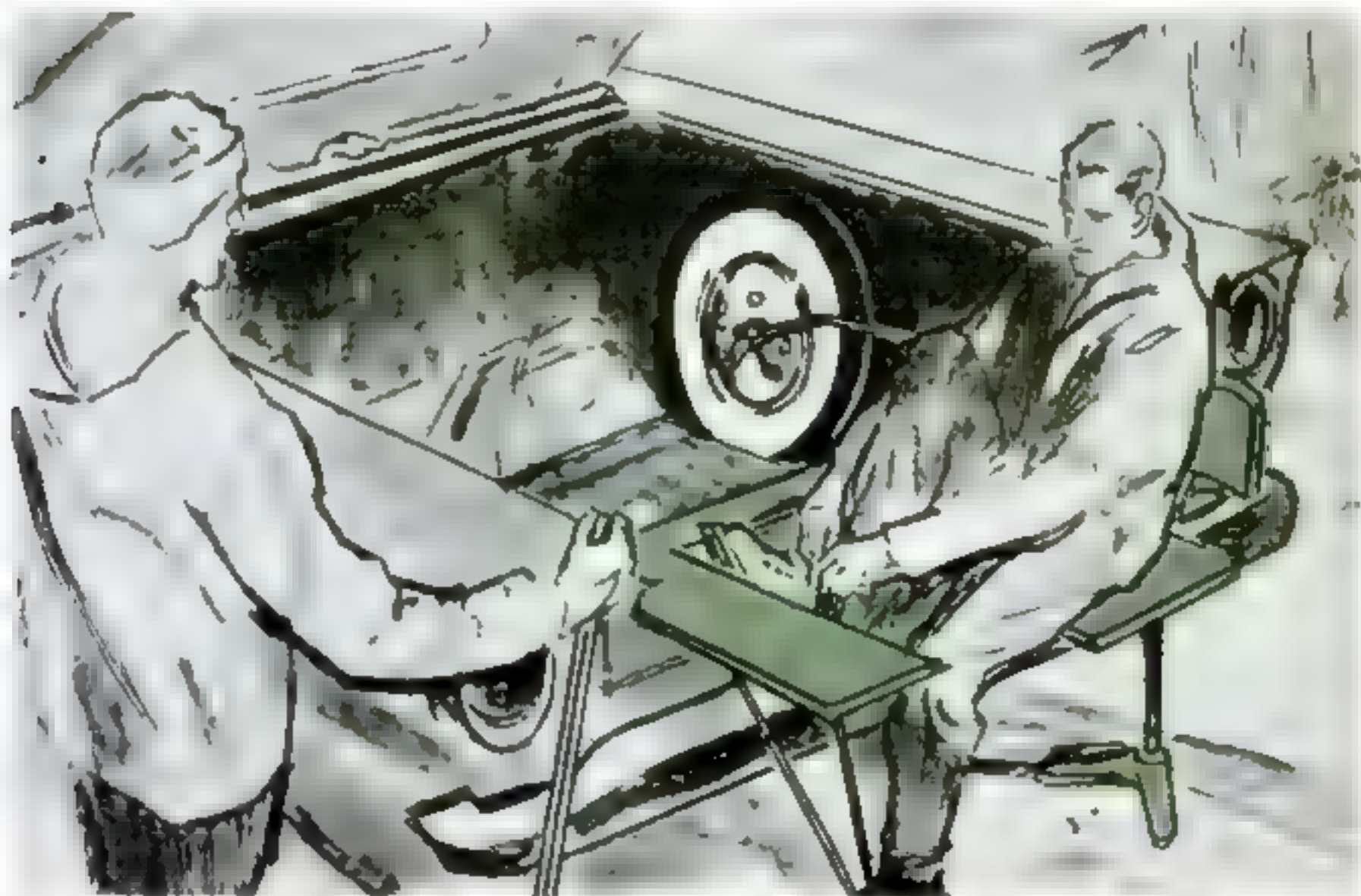


Venetian-blind air brake

An air brake atop an experimental Mercedes loads the engine and transmission so that on German autobahns 85 m.p.h. has the effect of 100 m.p.h. High-speed test runs can be made at simulated steady speeds without interruption from slower vehicles. Slats are angled from inside by the driver to vary air drag.

New Ideas from the Inventors

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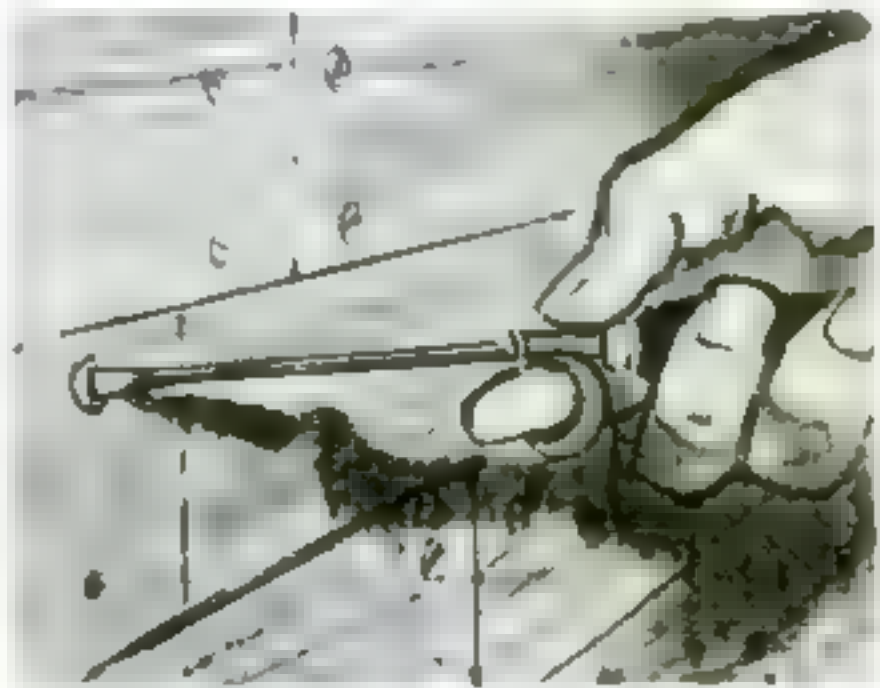


Seat Folds Out of Trunk. Hinged outward from a car trunk, this recently patented compact seat would make it easy for a skier or sportsman to change his

shoes or ready his equipment. A telescoping arm would adapt the seat to most cars. Carried flat in the trunk, the table would hook onto a support rod.

Hearing Aid Fits Tooth. Electrical impulses carried by facial nerves, say the inventors of this device, could overcome some types of deafness where amplification is not enough. To reach the nerves, they'd fit a tiny radio receiver into a filled tooth, use a pocket transmitter to broadcast signals to the receiver.

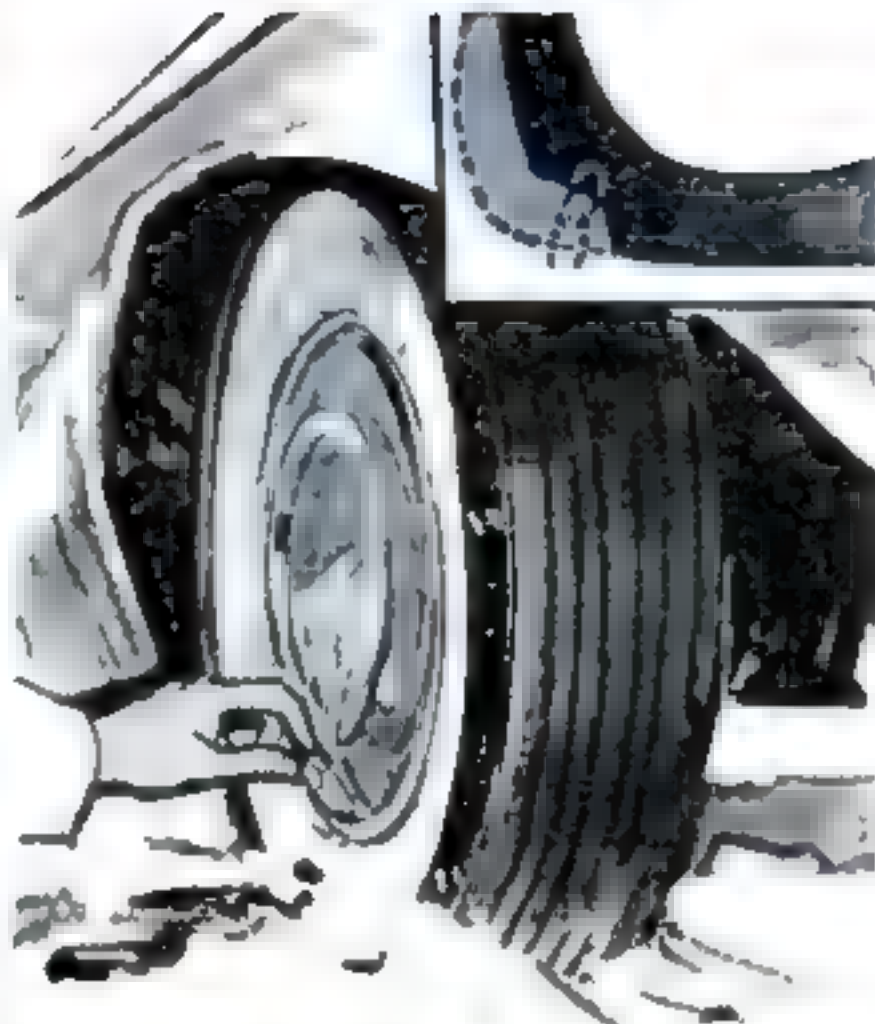
Ring Improves Screwdriver Grip. A finger-fitting ring that turned freely around the shaft might eliminate slips when tightening a screw. With forefinger in the loop, you could maintain pressure on a screwhead at all times. This would keep the blade from slipping as you turned your hand to get a fresh grip.



More Inventors' Ideas



Cuff "Links" Keep Cuffs Clean. These elongated slide-on cuff clips would protect cuff sides from soiling and fraying at points of greatest wear. They would also add a novel decorative touch. The springy clips could be used either on doubled French cuffs or on the conventional single-ply button type.

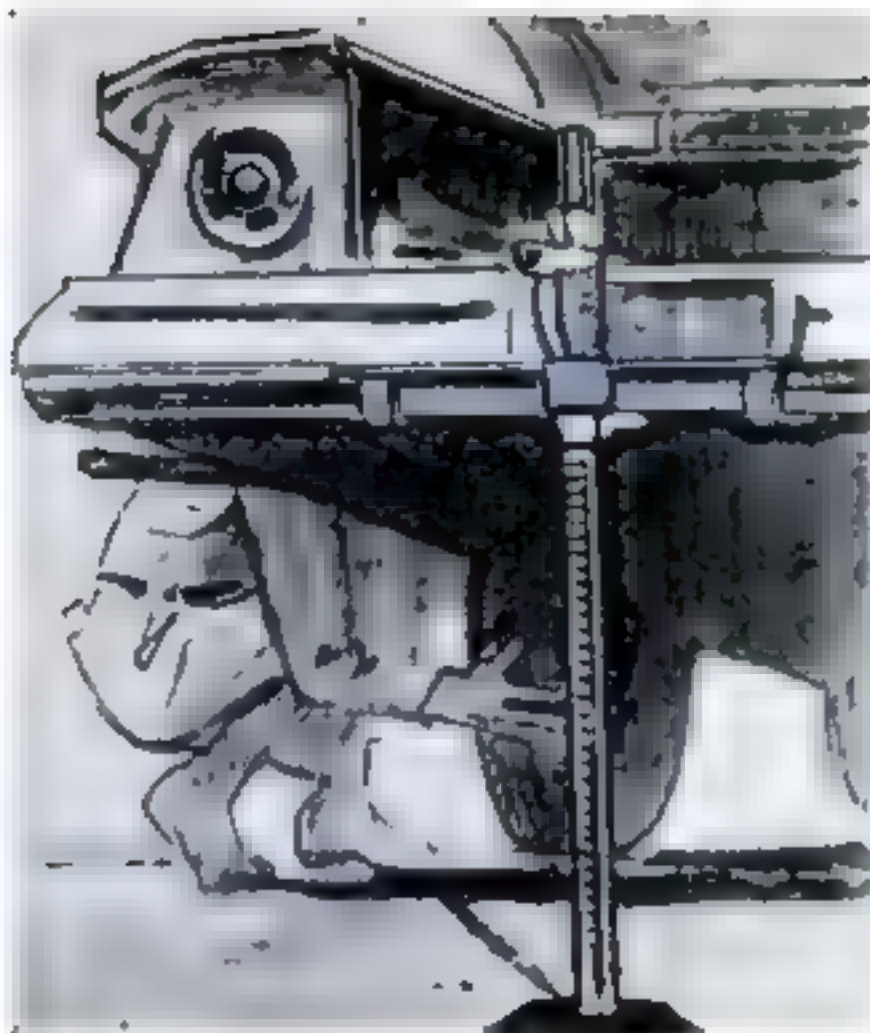


Let-Down Tire Grips Ice. With spikes like these (inset, top right) embedded in the shoulders of your tires, you could gain icy-road traction when you needed it just by letting out a little air. Flattening the tire tread would put the points in contact with ice or packed snow, giving you positive traction.

Cart Guide Speeds Marketing. You could find things faster in a supermarket if shopping carts were equipped with clipboards attached to the push bar. The

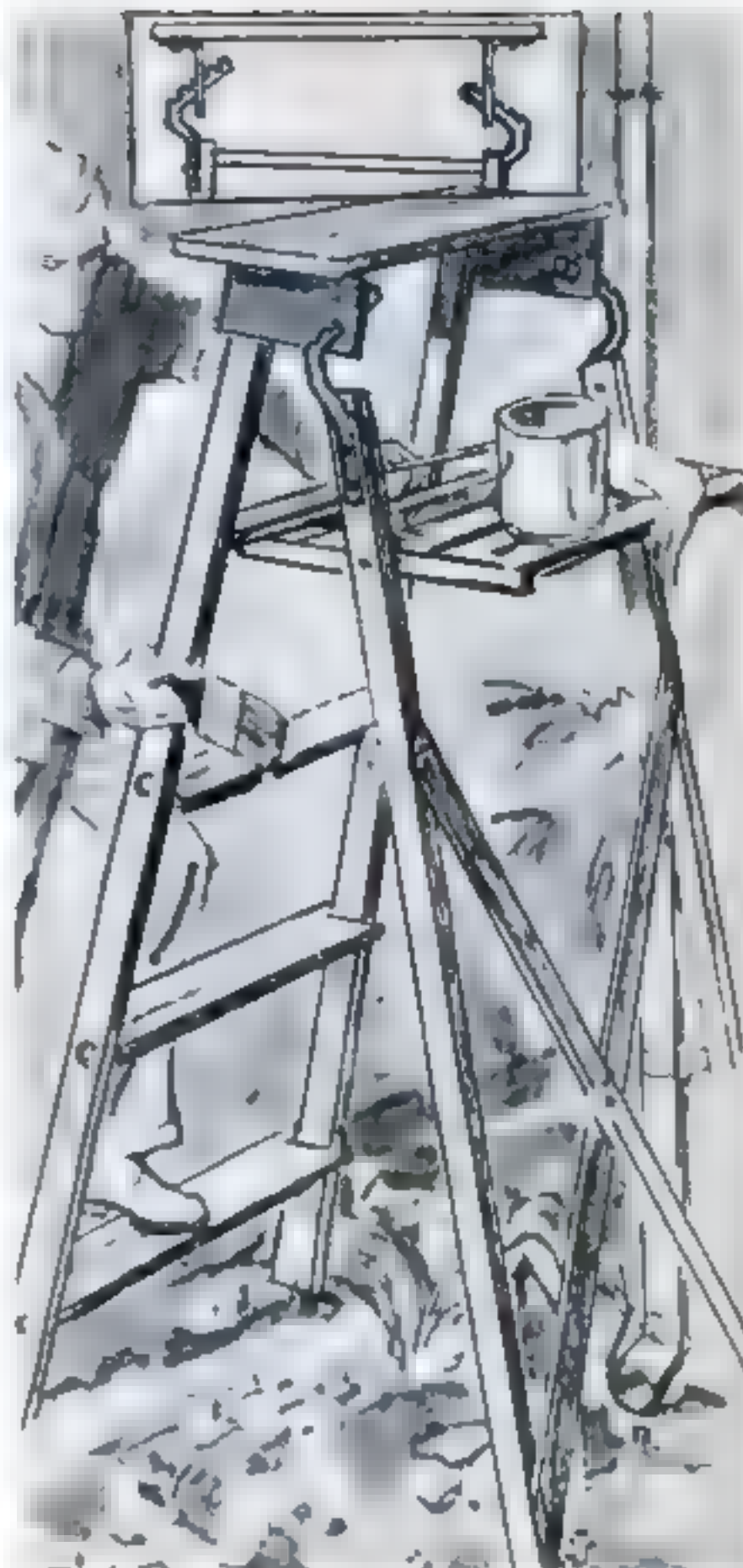
boards would hold a directory keyed to store location signs, and perhaps notices of the day's bargains. There would be a space to clip on your shopping list.





Jack Extension Levels Car. You could rotate tires or switch summer and winter treads more easily with a horizontal-beam jack extension that raised two wheels at a time with safety. Replacing the conventional single hook on a jack post, this double-hook bumper-gripping arm would provide the tip-proof lift of two jacks.

Lunch Box Warms Food. You could enjoy hot meals on the job if you carried your lunch in this portable warming box. Connected to any outlet, a U-shaped electrical element in the base would quickly warm—or even cook—food placed in a removable inner dish. The compact box could be placed in a larger lunch pail, or, compartmented, it could carry a meal.



Ladder Levels Itself. Notched arms connected to the top of the rear legs—and openings in the platform bracket—would allow this ladder to steady and level itself on uneven ground. You'd jiggle the unloaded ladder to adjust the reach of each leg; then your weight would lock the ladder against further movement.

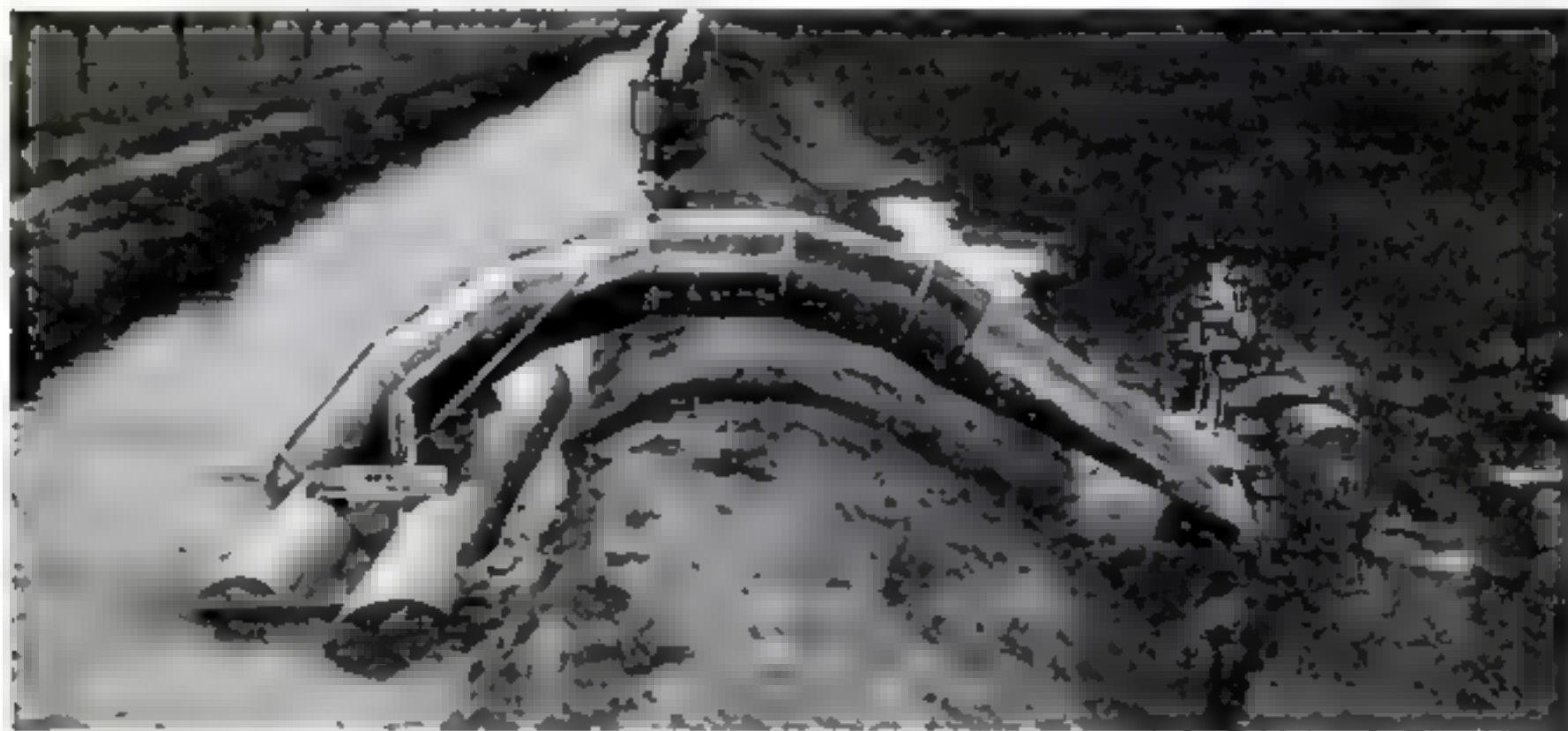
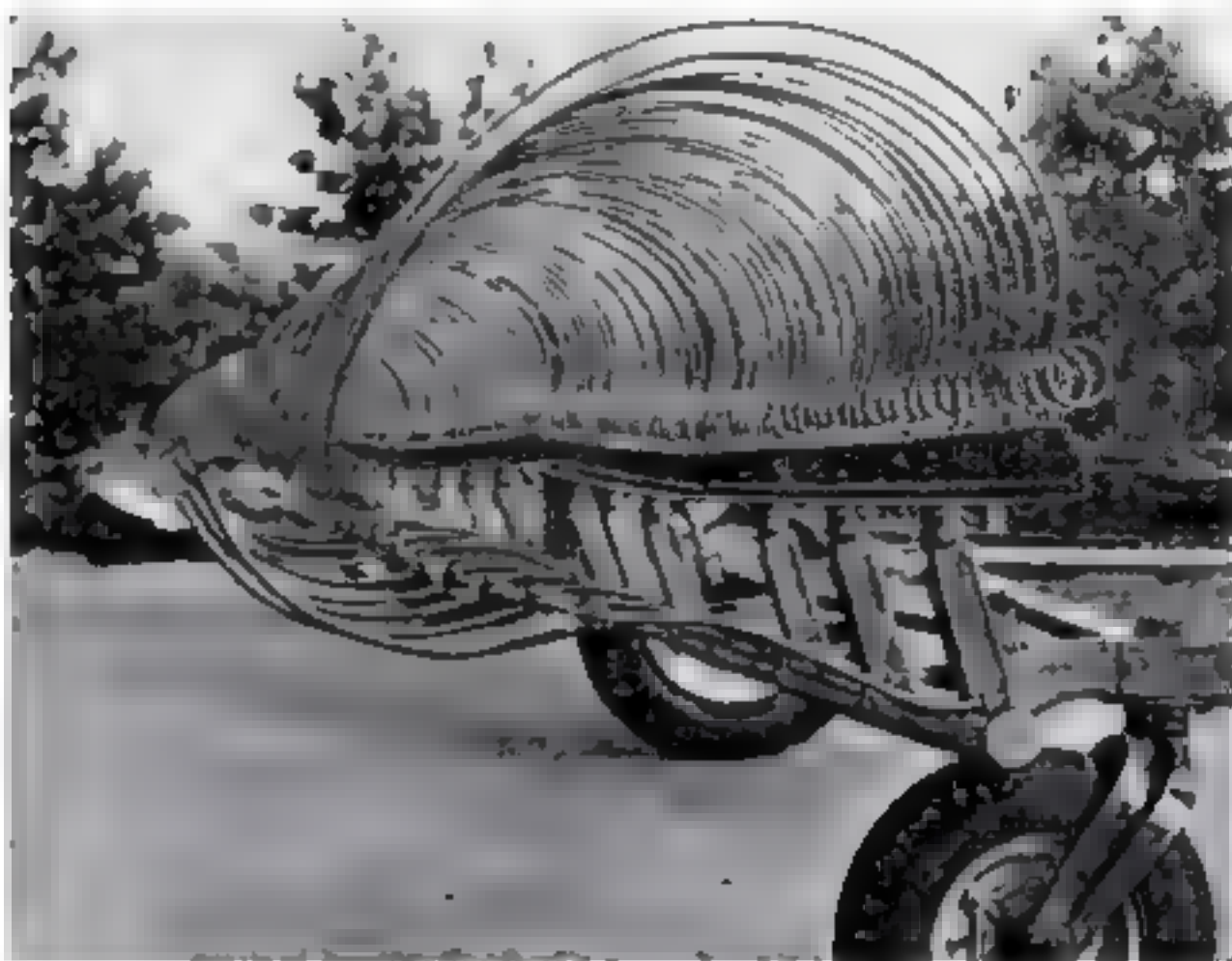
The following patents have been issued on these inventions. Trunk seat—No. 2,834,398 to K. Theisen, Macomb, Ill.; Tooth radio—No. 2,995,633 to H. Puharich and J. Lawrence, NYC; Screwdriver—No. 2,884,972 to C. Hottel, Battle Creek, Mich.; Cuff clips—No. 2,888,723 to S. Boruh, Flushing, N. Y.; Tire spike—No. 2,888,017 to F. Hildebrandt, Morrow, Ohio; Cart directory—No. 2,888,561 to J. Miller, Middletown, Ohio; Jack—No. 2,882,012 to W. Luna, Oklahoma City; Lunch box—No. 2,889,443 to P. Dobmeier, Chicago; Ladder—No. 2,890,823 to J. Bendick, Winnipeg, Canada.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D. C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

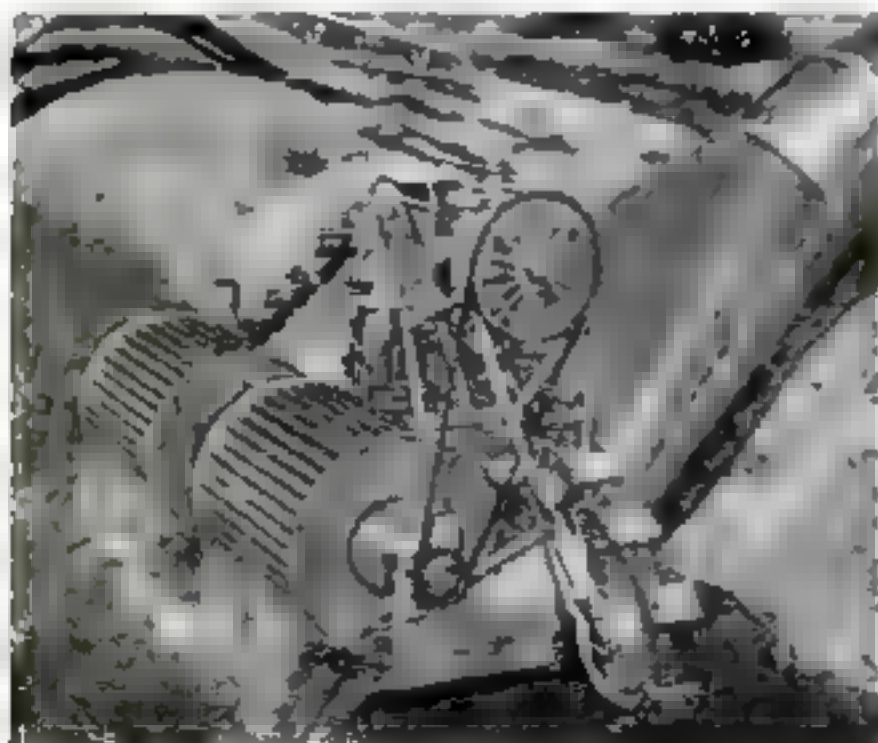
This mower cuts lots of grass

The giant machine stretching across nearly two pages at the right could be the granddaddy of all lawn mowers.

A Russian contraption, it measures 42 feet from the cutting bars at far right to the lifted-up forks at the rear. It mows 22 acres of steppe or meadow an hour. Lowered, the forks spread the cut grass for faster drying



Stovepipe siphon, arching over canal embankment, has its water-intake end mounted on pontoons.



Walking siphon irrigates farm

Two undershot water wheels turning a cleated track through chain drive help the University of Wyoming irrigate its experimental-crop fields. One end of a siphon floating in an irrigation ditch sucks water over the side to turn the wheels while soaking the fields. Cleats act as feet, moving the device slowly down a field at a rate that can be regulated from a little less to a little more than a foot a minute. All a farmer need do is start the siphon.

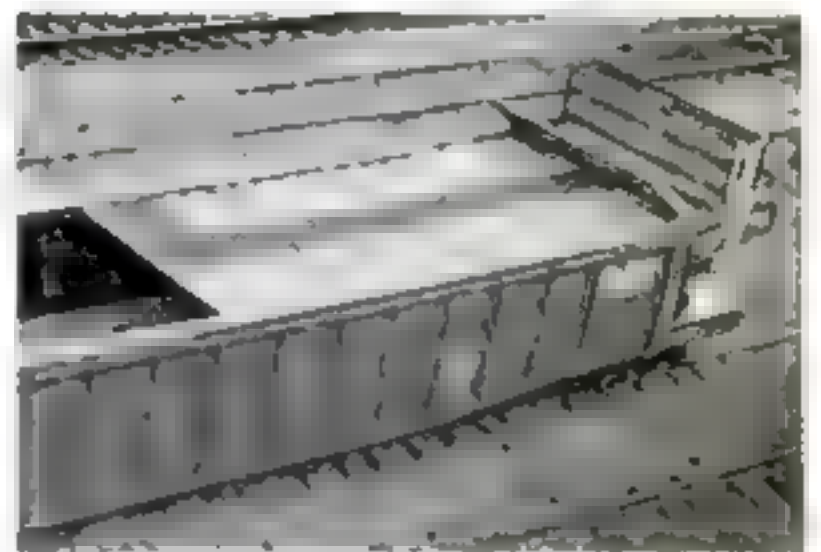
CHAINS AND SPROCKETS turned by water wheels drive "walking" cleats along the embankment.



Folding-roof rail car

A weatherproof roof made up of interlocking panels and opened by pulling its sections to one end, like a tracked folding door in a building, is being put on railroad gondolas.

The panels ride on rollers in tracks at the sides of the car. They are opened or closed by an endless chain operated by a hand crank at one end. The roof is adapted from a European model. Railroad Supply and Equipment, Inc., of Clark's Summit, Pa., builds it for truck trailers as well as railroad cars.



Fuel-tank iceboat

A salvaged tip tank from a T-33 jet trainer provided the hull for a speedy propeller-driven iceboat built by S/Sgt. Clyde Reed and his father-in-law, Otto

Erisch, at Selfridge Air Force Base, Mich. Powered by a 65-hp. Continental aircraft engine, the ice vehicle has been clocked at 132.4 m.p.h. For a real thrill, Reed sometimes rides behind on skis—but not at top speed.



Portable Drawing Board

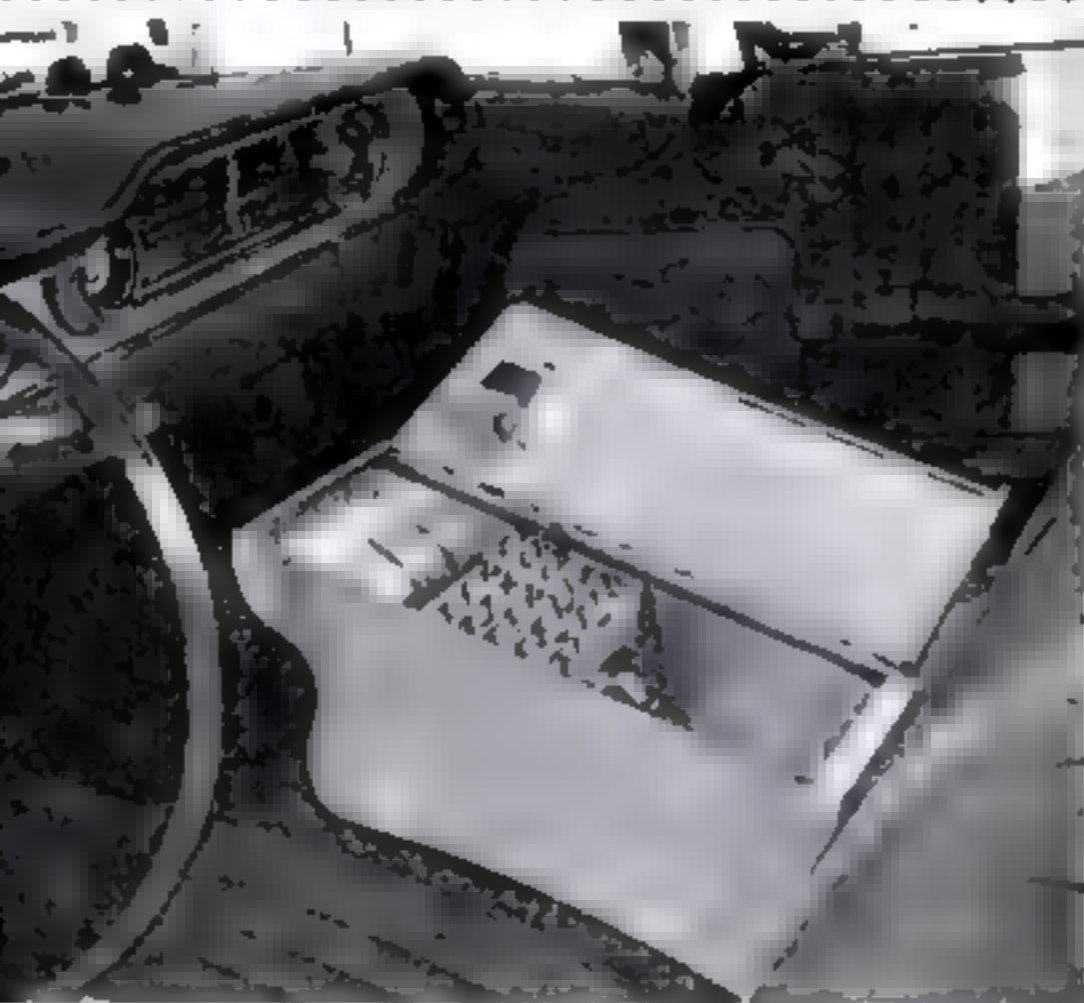
Fold the lid and lock it with the T square through slots, and you can carry this drawing board like a suitcase from office to home or for work in the field. The 21½-by-20-by-26-inch wooden case has room for instruments, finished drawings, and extra paper. \$21.95. Draw Master Co., 5831 W. Augusta Blvd., Chicago.



WINE RACK holds 12 bottles on their sides as experienced wine drinkers prefer. It's in three units that you can stack on top of each other or use separately. They are made of high-impact plastic that looks like antique fruitwood and are decorated with a French provincial design on front and back. Three Chateau units cost \$10. Hudson Valley Craftsmen, Scarborough-on-Hudson, N.Y.



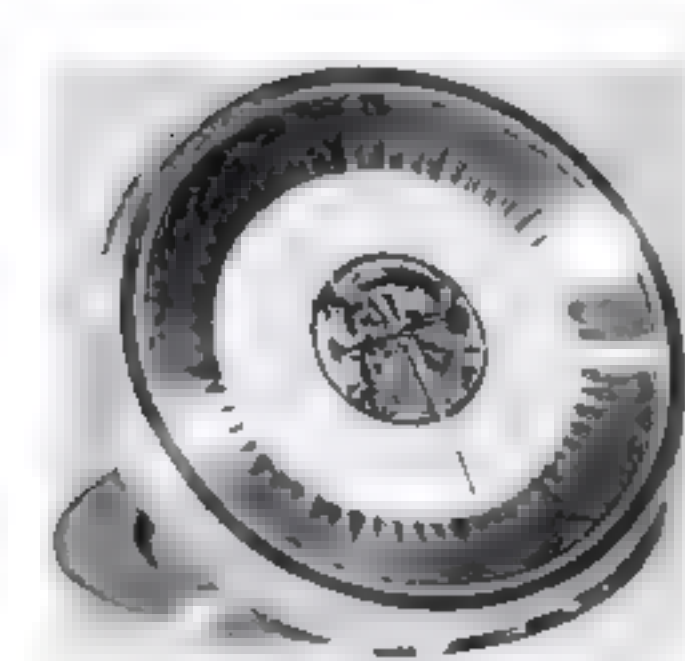
POCKET-SIZE BLOWTORCH is equipped with a soldering tip that you simply push over the end to use. Kidde Jet King is fired by a small butane cartridge that gives you 30 minutes of brazing, soldering, or sweating. Two extra cartridges can be obtained for 49 cents. Torch, tip, two cartridges, and length of all-purpose solder, \$3.45. Ronald Bitt, 261 Kempton Dr., Berea, Ohio.



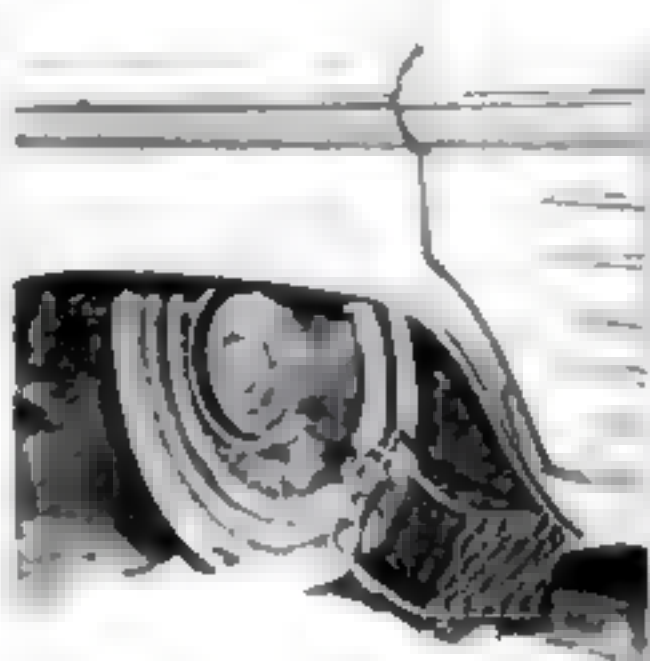
TRAVEL FILE is vinyl-laminated steel case with upholstered top for front seat of auto. It provides an armrest for driving; flip the hinged lid, and it's a filing cabinet with indexed card file. Red, blue, green, gray, or beige, \$12.95 with cards and index. Kay Tool & Die, Inc., Martin Hwy., Union City, Tenn.



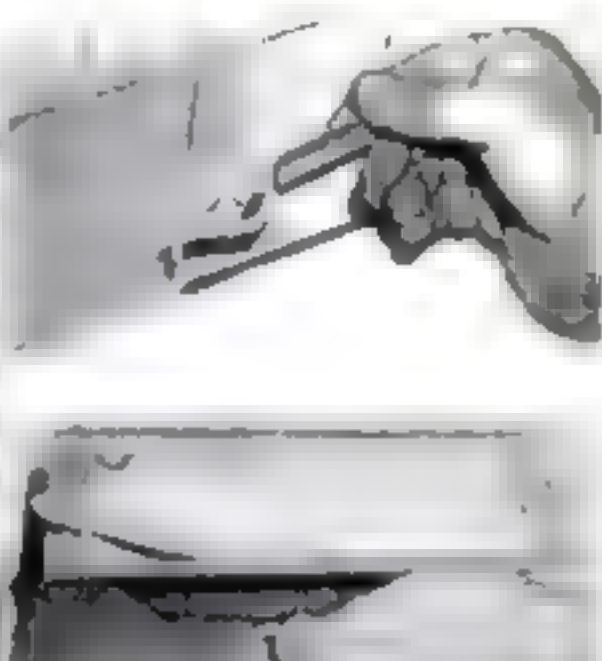
PLASTER PATCH remains flexible to expand and contract when you brush and squeegee it on a crack, sandwiching glass fabric between coats. In colors, \$1.79 a pint, \$2.79 a quart, \$9.40 a gallon; fabric, 98 cents for 3 $\frac{3}{4}$ -inch-by-18-foot roll, \$1.45 for 5 $\frac{1}{2}$ inches by 90 feet. Tuff-Kote Co., Woodstock, Ill.



CORDLESS CLOCK is run by vibrating tuning fork powered by transistors and replaceable cell that's good for a year. It's a desk version of Accutron wrist watch [PS, Dec. '60]. Space View timepiece is \$175. Bulova Watch Co., Bulova Park, Flushing, N. Y.

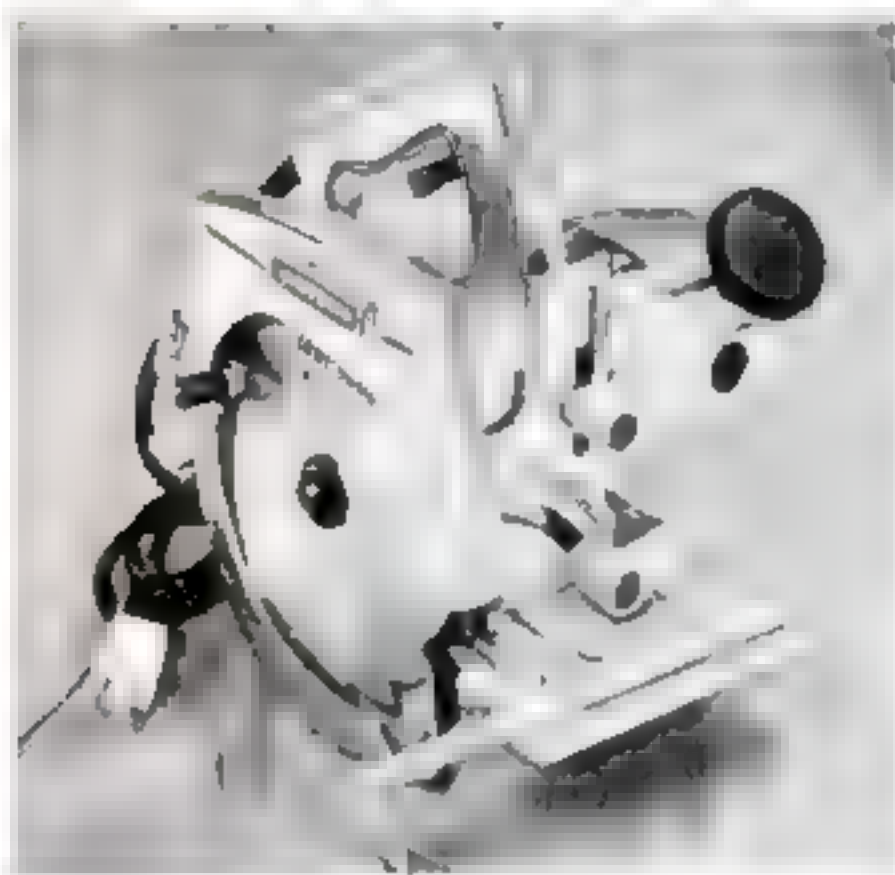


TRACTION SPURS are steel frames and treads that clamp on rear tires to get you going when you spin on ice, snow, mud, sand, or gravel. They lock without tools. Pair costs \$8.95. Inland Precision Products, Inc., 3504 N. River Rd., Franklin Park, Ill.



GROUT PATCH KIT contains all you need for ceramic-tile repairs and calking between wall and tub or sink. Packed in plastic mortar box are $\frac{3}{4}$ pound of grout mix, mixer-edger, and trowel. \$1. Instant Crete Corp., 1134 E. St. George Ave., Linden, N. J.

WHAT'S NEW



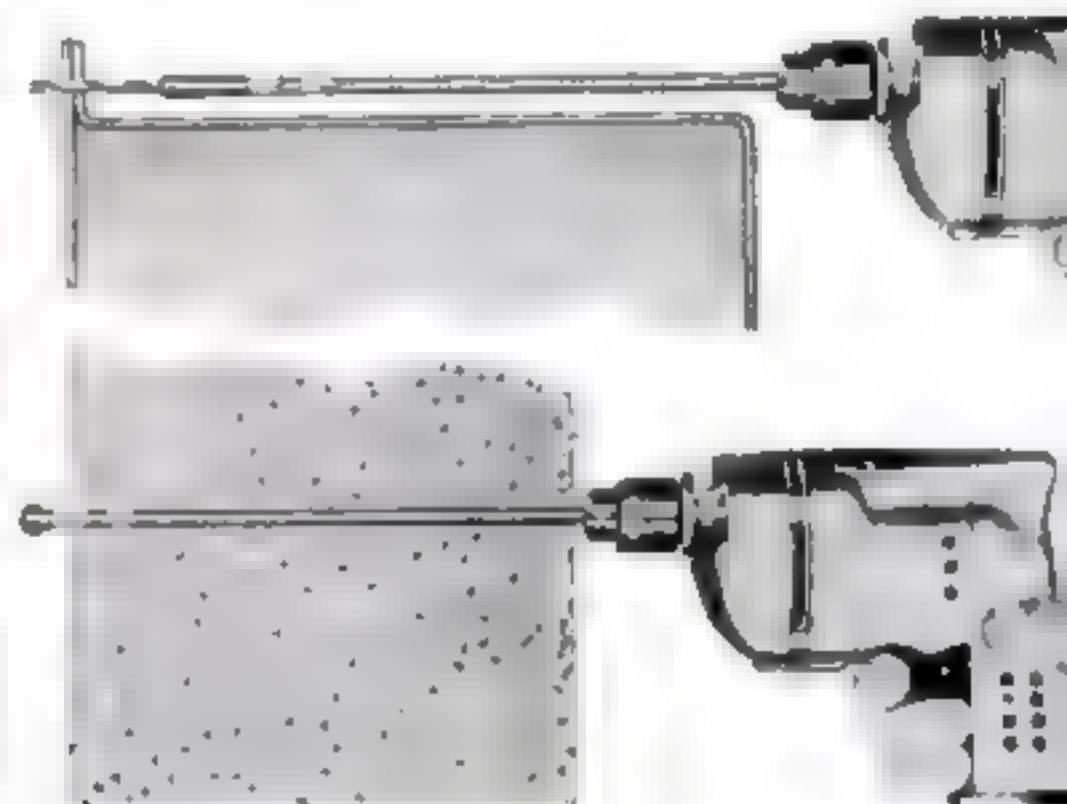
ELECTRIC HANDSAW has safety switch that lets it work at full capacity without overloading. Heat sensitive, it stops instead of slipping, but starts up again almost instantaneously on slight cooling. Heavy-duty Craftsman with 6½-inch blade sells for \$50. Sears, Roebuck & Co., 925 S. Homan Ave., Chicago.



SLIDE PROJECTOR looks like TV cabinet. It has rear-projection system with magazine capacity of 60 slides that you can operate by remote control, focusing and cycling forward or in reverse while sitting with your audience. Argus 580 is listed at about \$400. Sylvania Electric Products, Inc., 730 Third Ave., NYC.



CAR ALTIMETER mounts on dash, tells you how high you are above sea level when driving in mountains, and also gives you barometer reading so you can forecast tomorrow's weather. Dial is set beforehand to known altitude or barometric pressure. Available in three ranges: zero to 5,000, 10,000, or 15,000 feet. Each is priced at \$12.50. D. Corrado, Inc., 26 N. Clark St., Chicago.



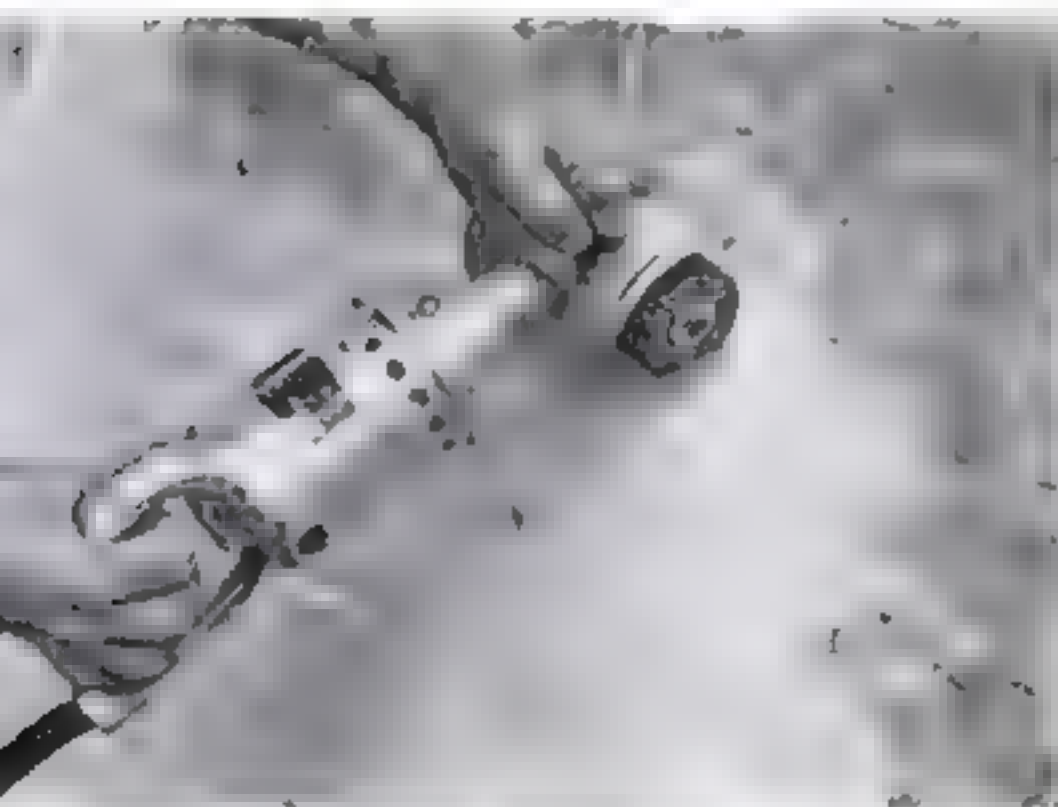
EXTENSION CHUCK adds 12-inch reach to any ¼-inch drill when you are working on steel, aluminum, plastic, or wood in hard-to-get-at places; or with carbide-tip adaptor it drills through thick masonry. Drill-Mate with one high-speed twist bit (size 1/16, 1/8, 1/4, 3/8, or 1/2 inch) and one 3/8-inch carbide-tip adapter costs \$4.95. Beaver Tool Co., Box 65, Pompano Beach, Fla.



MOISTURE METER inserted in soil tells you when house plants, garden, or lawn need watering. Moisture at end of prong sets off electric current that operates pointer to indicate wet, moist, or dry condition at roots. Sprinkle Minder costs \$4.95. Barclay Engineering Corp., 1234 W. Fulton St., Chicago.



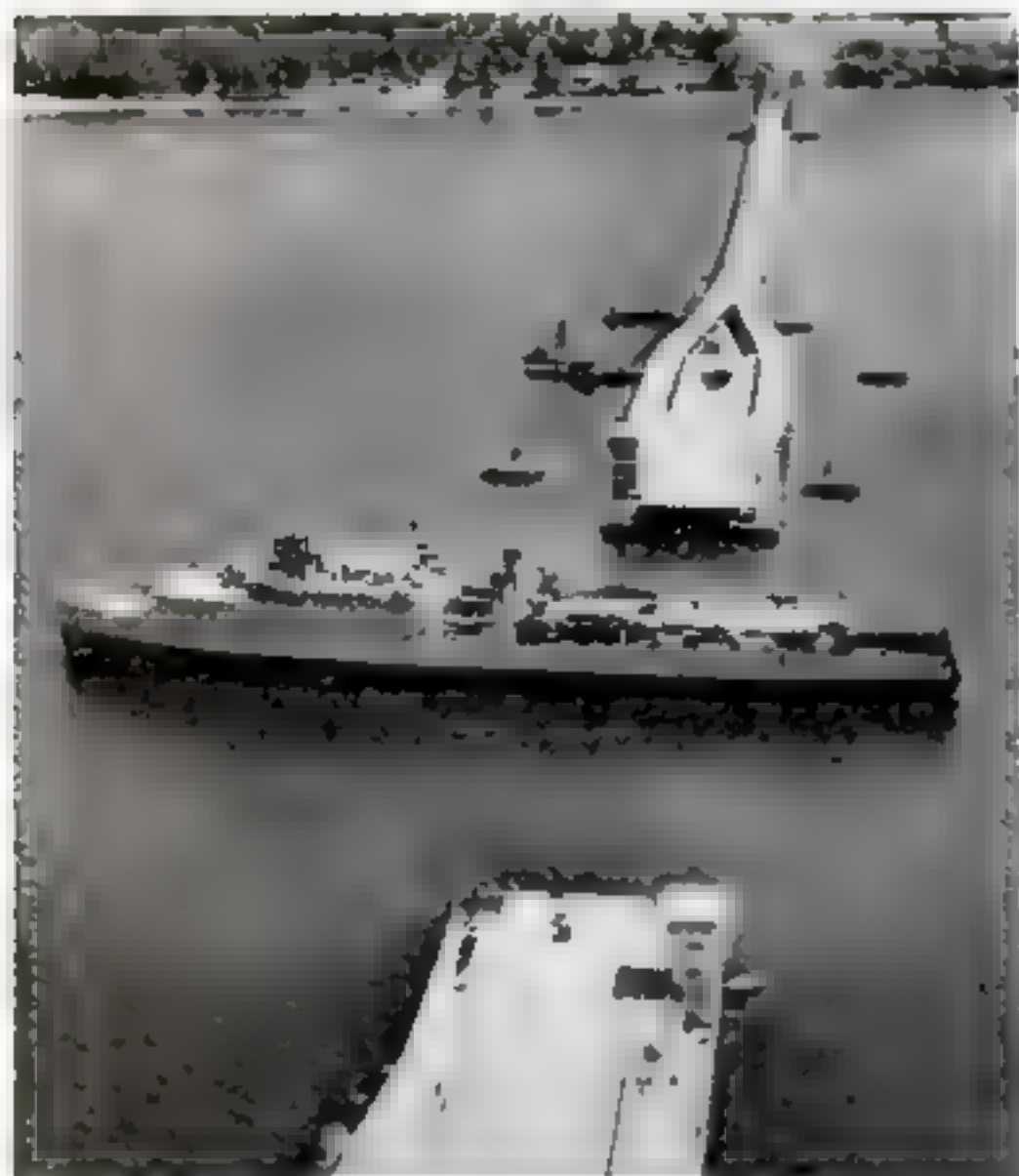
INSTANT-INK CAPSULE for Parker 61 fountain pens contains ink concentrate sandwiched between thin sponges. It fills pen with enough ink for 5,000 words when you place it on end of barrel and dip it in a glass of water or under tap. Three capsules sell for 29 cents. Parker Pen Co., Janesville, Wis.



POWER CLEANING TOOL uses a rotary scraping and chipping action to remove scale, rust, paint, or epoxy resin from metal, masonry, and other surfaces. Work is done by toothed cutting wheels loose-pinioned around ends of high-speed rotating head. You can adjust depth of cut. A lightweight 110-volt model is priced at \$145. Aurand Mfg. & Equipment Co., 1210 Ellis St., Cincinnati, Ohio.



BATTERY CLAMP curved like a C fits over terminal frozen tight by corrosion. When you turn down the hex-head bolt through threads in its body, terminal becomes unstuck and you can lift it off. Open ends of C are sharpened to bite through corrosion without damage to terminal post. Price, \$2.45. Burroughs Tool & Equipment Corp., 2439 N. Burdick St., Kalamazoo, Mich.



SLIDING DRAWSPANS are pulled inside huge Ys to let big ships through. Small vessels go under high arches at either end. Controls for movable sections are in towers at open end of Ys. It takes only 90 seconds to slide spans back for a 600-foot opening to let ships pass through.



ROADWAY IS SUPPORTED on concrete pillars that rise high above floating boxlike concrete pontoons. No traffic runs on lower deck. It's to let storm waves wash through well under passing cars and trucks—but there's talk of permitting fishermen to use the lower deck in calm weather.

Floating drawbridge spans tidal waters

A mile-and-a-third chain of massive steel-and-concrete barges floats on an arm of Puget Sound. Bobbing almost imperceptibly as the salt tide ebbs and flows, it forms a highway link across Hood Canal between Kitsap Peninsula just west of Seattle and Olympia Peninsula on which Olympia National Park is located.

The second floating bridge in the area, it took nearly three years to build and had cost \$26,750,000 when opened late last summer. The first, completed in

1940, is 6,561 feet across Lake Washington at the eastern edge of Seattle.

Unlike its predecessor, the Hood Canal bridge is subject to strong tides. Its 23 boxlike pontoons are anchored on both sides to 42 concrete blocks—40 feet long, 20 wide, 15 thick, and weighing 550 tons—to keep them from swaying with the tide. Joined by steel cables, they rise and fall 18 feet on huge hinges at the ends. Retractable center spans open a 600-foot passage for ocean-going ships.

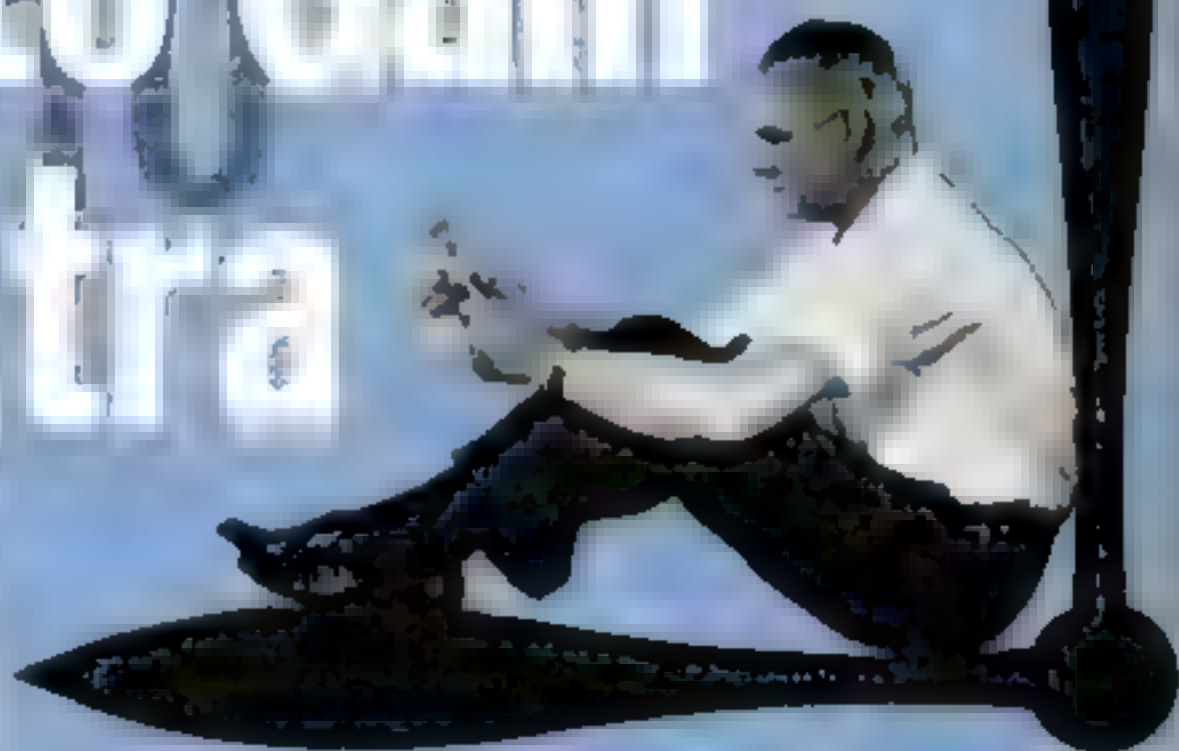


Continental wheel for British Anglia

A wheel cradle designed for the British Anglia carries the spare under a hinged lid with a cutout that exposes half the hubcap for tail-end glamour.

The license plate screws on behind, with the standard bumper fitted on the trailing edge and bolt-on brackets to support the cradle. The compartment is molded of fiber-glass the full width of the car, weighs 23 pounds, enlarges trunk capacity, and adds 15 inches to length.

How to Gain an Extra Hour Every Day



I DON'T know where my days go. I never have time . . .

"To see my friends more . . .

"To read . . .

"To help in community and church activities . . .

"To make the projects I plan . . .

"If I only had the time!"

Do you often feel rushed—harassed—short of time? That you're not having the fun you want?

Most of us are in that position. Yet the busiest people find time for extra things they enjoy doing.

What's their secret?

I got the answer from hundreds of successful people. It's their ability to get an extra hour from every day.

Former President Eisenhower, Bernard Baruch, Mrs. Eleanor Roosevelt, Norman Vincent Peale, New York's Mayor Robert Wagner, and scores of others told me that gaining 60 minutes more each day can make your life fuller, pleasanter, less crushed. It can be your blueprint to achievement, the thing that puts you ahead in your job and community.

All of us start with the same 1,440 minutes each day. No matter how rich, you can't buy more. No matter how poor, you won't receive less.

We spend eight hours in sleep, the same number at work. The rest becomes the time when we have freedom of choice.

However, we find these hours hardly enough, with small opportunity to do the things of which we dream.

Yet there is a way. You must hoard minutes. Forget big hour-saving ideas. Concentrate on five-minute timesavers.

Mrs. Eleanor Roosevelt, who seems to accomplish as much as half a dozen people, says that timesaving boils down to three essentials:

- Eliminate the unnecessary things that fritter away time.
- Stop doing what you must the hard way; *simpler* is faster.
- Teach yourself to do two or three things together.

"Look at your daily activities with a fresh eye," Mrs. Roosevelt says. "Business has engineers who make the simplest-seeming task easier. Finding your best system will do the same for you."

No one of the famous people mentioned here uses all these devices. Some ideas contradict others. That's inevitable. What works for one person isn't necessarily effective for another.

Your Morning Routine

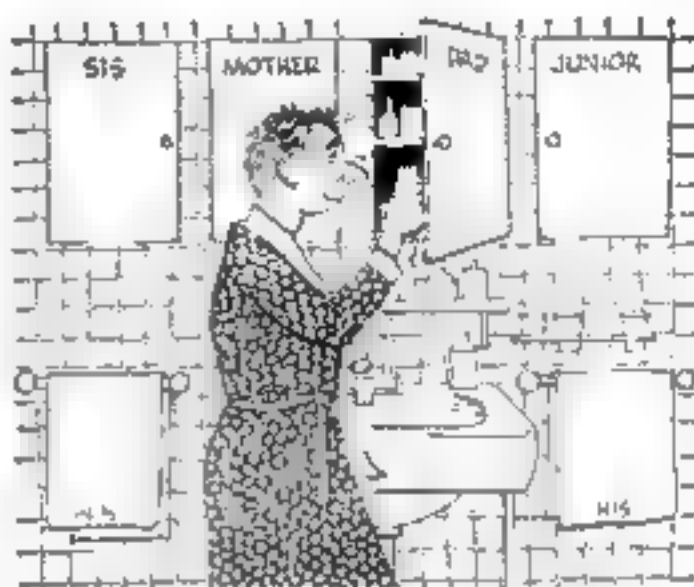
No matter what you do, you've got to wake up. Let's begin with morning routines that get you going faster.

Getting up. Arthur Godfrey says: "One method saves me 20 to 50 minutes a day. I get up when I wake up. Linger in bed, hoping it isn't as late as you know it is, only delays the inevitable."



Bernard F. Gimbel, of the retailing family, says: "I think of the pleasantest thing I have to do that day. This gives me the spirit to get up then and there."

Have you checked that bathroom? One problem most families face is too few bathrooms. Check with the eye of a time-and-motion expert to discover delay makers. Are items you use daily handy—and others on upper shelves? Try installing extra shelves and towel racks. If each member of the family is given his own space, countless minutes unscrambling things may be saved.



Mechanical hurry-upper. Try a radio in your bathroom. It will give you the news, and time signals will speed you up.

Vertical is faster than horizontal. If you're a morning bather, showering can cut time one-third. Recommended method: Rinse, soap quickly, then lather, starting from the top down. Newspaper columnist Earl Wilson says he's learned to shave and shower simultaneously, saving five minutes a day.

If you're going to shower, shave first—then you needn't rinse lather off separately.

Use pushbutton instant lather instead of a brush.

Give a fair trial to an electric shaver. An electric saves time by eliminating moistening and lathering, clean-ups and cuts. Some men shave without looking in the mirror, and can read the paper.

Speeding up your dressing. Bert Bacharach, men's-wear authority, made these suggestions:

Put clothes on a hanger, wishbone shape. Don't button buttons. Use a trouser hanger instead of bar of coat hanger to keep creases sharp. Let suits hang a day or two between wearings to regain shape; use rolled sleeves. Take out spots by rubbing with plain water; brush dirt out. You'll save time sending suits to the cleaner's. Hang ties on a rack by colors to make selection easy.

Oscar Schoeffler, men's fashion editor, adds: Select your suit first, then shirt, tie, socks, and shoes to go with it.

Have a different belt attached to each pair of trousers. This saves time taking it on and off.

For overnight trips, keep a case ready with just a change—thus saving time in packing and unpacking.

Making things handy. Roy Fruehauf, maker of the truck trailers bearing his name, put two plastic ice-cube trays in a dresser drawer. Into these are dumped change, car keys, cuff links, tie clasp—automatically compartmentalized by the tray. Saves up to five minutes a day.

Reorganizing pockets. What do you carry with you each day? Your wallet is probably stuffed with useless cards, photos, clippings. Sort out the

BOOK DIGEST: HOW TO GAIN AN EXTRA HOUR

cards you really use. Put in little plastic holders. If you want to carry photos, pick two or three. A man's indispensables include an identification card listing social security, insurance, membership, and other essential numbers, instead of the separate cards.

Your Working Day

You may have a job in an office or shop. You may run your own business. You'll find ideas to help you move ahead while relieving the pressure of too many things to do in too little time.

Getting there. One of the greatest timesavers is to arrange to live near your job. Walter B. Pitkin, who wrote *Life Begins at Forty*, lived where he could walk to work. He would awaken as if commuting, then use the extra time to do additional things.

Finding work more easily reached from home may be worth taking less pay. Hourly earnings should be figured door to door. Cutting two hours' commuting time each day means 10 hours in a week.

Simplifying your work. Check these questions:

Why is it necessary at all? You may find you're doing certain things out of habit.

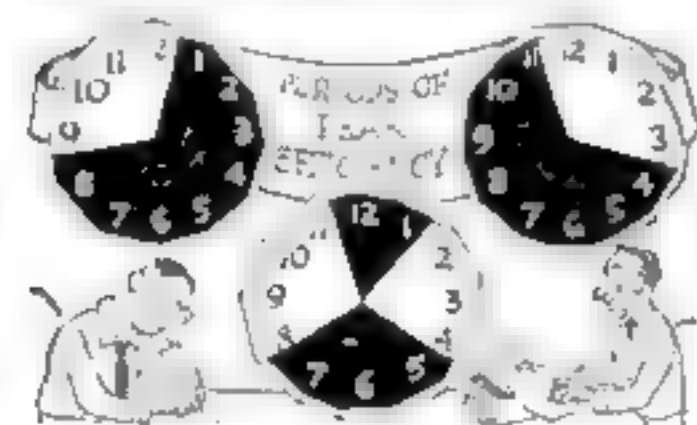
Where should it be done? Is the place where you conventionally do the job best with regard to light, ventilation, and facilities?

When should it be done?

Who should do it? If it's a home task, would your wife or the youngsters share this job? Sometimes it's more economical to get professional help.

What's the best way to do it? Are you doing a lot of unnecessary running around to get the job done?

Working at your best hours. "I'm really going great guns this morning. Everything's getting done in half the time." You've made that remark. All of us not only have better and worse days, but hours. We are likely to fall into one of these three types:



- The Morning Type wakes up ready to go, reaches his peak around noon, then cools off gradually.

- The Evening Type goes through the morning listless, but soon after noon he begins glowing.

- Type 3 has the virtues of both the others—gets off to an early start, cools at midday, fires up again for the afternoon.

If you pick the best time, you'll get important tasks done quickly.

Organizing Your Work

One factor in getting more done in less time is to develop your own schedule. Not the kind that is so ambitious your life ceases to be your own; rather a schedule that lets you accomplish more with less effort.

Writing it down helps save time. William I. Nichols, editor of *This*

Week, says, "As you think of things you want to do, note them down. That saves lost minutes trying to remember."

Daily and weekly schedules. Fred Lazarus Jr., of Federated Department Stores, saves 25 minutes daily by writing out a one-week schedule. "Try listing things you want to accomplish in the order of doing—with the toughest first," he says. "Postponing wastes minutes. And it often requires two-thirds more time and effort."

Dr. Daniel Poling, famed clergyman and author, says: "Years ago I started dividing my day into 15-minute segments and writing out a program for each. I learned to compress into a quarter-hour what might have taken 30 minutes, gaining an hour or two daily. Now I no longer need the segments. The habit is automatic."

Radio can make your time segments. Many people speed up by timing tasks to radio programs. They listen to the radio news while breakfasting. "I don't have to watch the clock," one says. "I know by the program exactly how much time I have left."

Some people keep clocks minutes ahead to make certain they have a little extra time. It's a psychological trick—and often works. One man had



a special clock made with 13 rather than 12 numbers. Each of his speeded-up "hours" was only 55.4 minutes, and except at midnight, his clock didn't agree with anybody's in town. "But," he explained, "I soon conditioned myself to that and kept the 'left-over' time for things I really wanted to do."

Keeping a notebook. One of the best is the little pad with perforated sections. You write a note; then, when the thing is done, tear out the section and toss it away.

You'll find that little stacks of cards or note pads left in these key spots can also be valuable minute-minders: reading table, night table, breakfast nook, telephone stand, bathroom.

Writing instruments. In too many households, you have to waste minutes going through drawers for a pencil. This is particularly true where children adore hiding them in inexplicable places. Have enough pens and pencils always in the same places—desks, the kitchen, on high shelves where the youngsters can't get them, on the telephone stand, in a bedroom.

Family discussions. Set a definite time—say Sunday evening—when problems can be discussed. Instead of letting arguments consume time as they occur, refer them to this family huddle. Almost every clan gets into a hassle about who's going to see what television programs. Settle the question on Sunday evening when the whole week's schedule is available.

Your Working Methods

What's the fastest way to do things? No one has the final answer, but here are some ideas

Straight through or one at a time? Presidential adviser Bernard Baruch says: "Do one thing at a time and stick to it. If you learn to finish, you'll use time to best advantage."

Another viewpoint comes from Jerry Fields, head of an employment agency: "Trying to do all your tough things at one clip is like following a home-stretch pace all through the race. It's hard to keep up. One good rule: Take a 10-minute variation of tasks after each of the first three hours, 15 minutes after the fourth."

Frequently we have a great deal to do in little time. When that happens, Robert B. Smallwood, president of Thomas J. Lipton, Inc., says. "Try eating a heavier breakfast. Then skip lunch until three p.m. This gives you six uninterrupted hours. If you have many things to do in the evening, try eating a late lunch and not eating dinner until eight or nine p.m. With this system you can frequently complete jobs that would otherwise take days."

Saving time with callers. Use the "direction question" method developed by Harry Stack Sullivan: "The person who comes to see you usually has something specific in mind even if he can't express it. Don't be afraid to ask. A direct question will get him to say in the beginning what he might ordinarily say at the end, it can be a great timesaver."

When callers are known to be long-winded, prearrange an interruption that will end the talk. To discourage talkative interrupters try looking at the ceiling or window. They'll take the hint.

Writer William Lederer has this advice: If visitors haven't left by nine or ten and you have to rise early, just yawn, stretch, and tell them to make themselves at home, use the liquor, the icebox, and anything else, then head



for bed without apologizing. After word gets round, your real friends will call only at convenient hours—and they'll usually telephone first to see if it's all right.

Saving time on correspondence. Whenever you desire a speedy reply, enclose a self-addressed, stamped envelope. Underline the questions you want answered. Or make your note into a lettergram—a column that will make possible direct answers opposite the questions.

A number of people make carbon copies of family letters and mail them to the family circle with special postscripts for different individuals. Most

recipients don't mind, since they get the letter that might otherwise have been neglected or less complete

Stamped postcards with your name and address imprinted save time. They train you to keep messages short, get you into the habit of answering quickly. There's no need to scramble for postage.

Use a rubber stamp or stickers. "For years," insurance man Frank Crystal says, "I wasted time writing out my name. Then I found how inexpensive it was to have a rubber stamp made."

How to Save Time Reading and Remembering

Reading directly influences your income and success. Most people rarely have time to read all they'd like to.

First, make time by acquiring minutes that ordinarily escape you.

Second, choose what you read with care—and have reading matter available at every opportunity.

Third, speed up your reading.

Making time to read more. Always put in a conspicuous place books and magazines. Take at least one on any trip that's likely to give you even five minutes' free time. Such minutes add up.

Keep a book beside your bed. If you're unable to sleep, you'll have something worthwhile to read right at hand.

Keep good reading matter in such places as your kitchen, the telephone stand, even the bathroom.

Carry good books to read while waiting for your dentist, doctor, lawyer, barber—or even a tardy date.

Take reading matter in the car for traffic jams, repair jobs, or stops.

Choose reading with care. Concentrate on fields that interest you and let others go. Use news magazines to advantage. They give universal coverage and perspective. Read a weekly book review. Good criticism enables you to find the books you want to read. Evaluate the news. Read the paper through fast, then return to it later for items of interest. The same idea applies to magazines.

Speeding up your reading. Most of us are using only about 20 percent of our capacity to read. Slow readers get 150 words or less a minute, average readers 250, and exceptionally fast ones 700. Reading fast doesn't hurt your eyes. Rather, sweeping rhythmically down the page means fewer stops and starts, thus rests your eyes more.

Home training should consist of a daily session in a room away from noises and interruptions. These factors should be uppermost:

- Read with a purpose, not aimlessly.
- Make sure you're not moving your lips as you read.
- Avoid word-by-word reading. Train your eyes to take in whole phrases at a glance.



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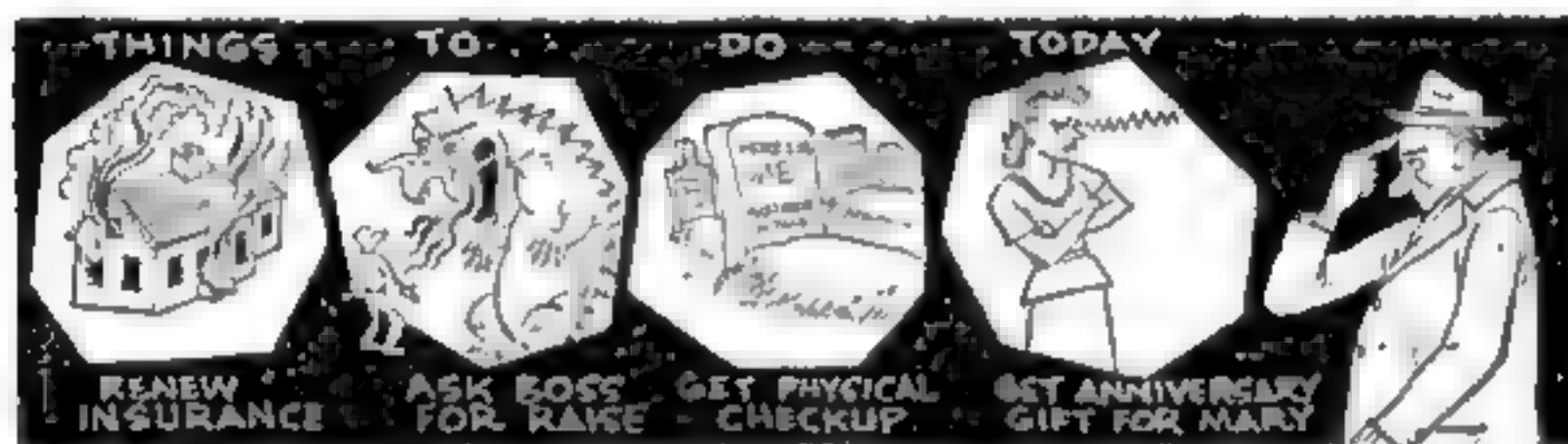
- Force yourself to read a little faster than you used to.

Don't be afraid to mark your own books as you read. Have the confidence to dismiss the trivial. Learning how to skip a lot of unimportant words can save you a lot of important time.

Improving your memory. The man who has dates and figures at his fingertips, can address an audience without notes, and can quote prices and details is usually successful and always widely envied. Many a promotion has resulted from a good memory.

Dr. Bruno Furst, top authority in the field, has developed many methods, but one of the best is associating a fact with a familiar object. He explains:

"When my wife asks me to change our fire policy, I picture my desk on



fire. The moment I open my office door, the image of my burning desk reminds me to write—and no time is wasted trying to recall what I am supposed to do.

"To ensure mailing it, I picture the insurance man standing at the mailbox. The sight of the box reminds me of him and the letter simultaneously. The same method works with names, facts, and numbers."

Speed-up study tips. John C. Villaume, Faculty Dean of the International Correspondence School, has developed a number of ideas:

Consider your after-work studies a reward. Say to yourself that the chance to study is a prize for successful accomplishment of your daytime schedule in less time.

Divide your studies. Six 20-minute periods can bring twice as much gain as practice for a two-hour period—though the total time is the same.

Nobel Peace Prize winner Dr. Ralph Bunche, to learn German, had pages from his grammar enlarged and pasted on the walls of his den. You can post things you want to remember on a bulletin board. Or slip the material to be learned under the glass top of a desk or bench—any place where you'll see it repeatedly.

Mechanical Minute-Makers

Busy people use every device and service that will help them organize time. Here are a number of the best.

The eternal telephone. Often you get information on the telephone that would take hours to obtain in person. When you call:

- Use a direct approach. The more specific you can be, the more quickly you get the person qualified to handle your problem.

- Make notes in advance and tick them off as you get information.
- Stick to the point. Don't go through a lot of roundabout explanations about your reasons for seeking information.

Refuse calls at certain hours. Since you don't let people into your home any time they choose, why yield to their voices? You can, on occasion, be "out" when the phone rings. Columnist Earl Wilson reports that actress-skater Sonia Henie answers her phone in a thick accent. If it's somebody who might want to talk pointlessly, Miss Henie reports that she is Miss H's maid and that Miss H is out. But if it's a friend, she giggles, "Honey, eets me, I was playing."

Personal phone list. If you don't keep a personal phone list, you will waste precious minutes getting wrong numbers or repeatedly looking up numbers. If you get a wrong number, just say you're sorry. It's foolish to waste time asking, "Who is this?" or what number it is.

Check phone location. Make sure your telephone is where you can answer with fewest steps. Often people go on using the telephone placed for the convenience of the previous occupant of the house.

If you don't want the expense of several phones, check on extra outlets. The bedroom phone can be taken downstairs during the day.

Long-distance calls as timesavers. Not minutes, not hours, but days can often be saved by immediate replies to questions, business or personal. Another timesaving service is the conference call. A special operator can arrange to connect you with a number of individuals at various cities in a sort of long-distance party line. Long used by businessmen, it's coming into popularity with leaders of professional societies, fraternal organizations, and even families.

Using your telephone correctly to save time. Allow time for the other person to answer. A good rule is 10 rings.

When the telephone you are ringing is answered, say: "This is Ray Josephs . . . Is so-and-so there?" Don't play guessing games.

Most business firms announce the firm name when answering. It's not a bad idea for home users either. A simple "This is Ray Josephs" would save lots of crosstalk.

Keep a pad and pencil near the telephone. Taking notes on the spot and leaving messages for others is a great timesaver.

Keep material for reference handy during the call, whether it's an insurance policy or the agenda for your club's next meeting.



An intercom saves time. Perhaps you've thought of the systems you've seen in offices as strictly for vast corporations. Yet some kind of intercom may save many minutes daily if you have a small business or even a house with more than six rooms. It enables you to stay where you are yet find out what you need to know.

Recorders and Cameras as Timesavers

When Queen Elizabeth and the Duke of Edinburgh made their globe-circling tour in '53-'54, they talked out letters on tape to be flown back to their children. The royal couple's use of tape recording made headlines. Actually this has long been a timesaving device employed by U. S. families.

John W. Schirmer, of the Webster-Chicago tape-recording company, says: "Most people find it easier to talk than to write. They tell more of themselves in far less time."

Many families take a recorder on trips—and send back tapes instead of postcards. Albums of family sounds, children's voices, baby's first cries, and birthday parties are replacing time-consuming diaries.

Tape to save teaching time. At Michigan State, Harold Rice, unable to take notes because of a hand injury, secured permission to bring a recorder to class. He put his microphone on the teacher's desk and got a full set of notes.



Tape for timesaving. Tape will let you hear a radio program at your leisure. And in families where father comes home after children should be asleep, mother records their dinner-table conversation and gets them to bed early. Dad gets the full accounting in the youngster's own words.

Using photography to save time. A glass dealer saves time by photographing installations. When he makes calls, his slides enable you to see the effect you want in minutes.

A swimming-pool salesman uses the idea, taking before-and-after photos.

A builder saves reports by taking progress photos. Pictures also serve for reference to determine where pipes and tanks are located.

A concern making windows and doors has pictures showing installation methods, making it impossible for the home owner to go wrong.

Streamlining Personal Chores

Unless you are an Indian maharaja with a corps of servants, you have to do for yourself every day a good many things that take time and energy. These suggestions can help:

Putting things where you can find them. Clear plastic boxes avoid the need for labeling, and prevent needless searching.

Choose a household key center with keys on plastic holders on which you can write identification.

Keep items used together in the same place. For example, golf things, requirements for an overnight trip, special items.

Duplicates save time. Razor blades—nicking yourself is foolish when for a few cents a day you can have a smooth shave each morning. Shoelaces—for a dollar a year, you can have enough to last indefinitely.

How about an extra pen, a dozen pencils, a dozen blotters? Keep a carton of matches in a drawer so that you'll have a light when you want it. It costs relatively little to buy three bottle openers, an extra ice-cube container, spare pocket combs, extra first-aid items, an extra hammer, pliers, screwdriver, nails, tacks, picture wire. Pencils, pads, scissors, and Kleenex in drawers all over the house will enable you to do chores without having to leave the room.

Records of family documents. Records may result in collecting money that you might lose. Banks have millions of dollars unclaimed by depositors. Firms are unable to locate owners of stocks, bonds, and dividends. The Social Security Administration, ex-servicemen's organizations, and unions report families who, because they've misplaced papers, have not obtained funds to which they are entitled. Make a simple, easy-to-record chart. Note car-key numbers, bank-account numbers, marriage-certificate dates, military serial numbers, and so on. Use it as a check list. Write for copies of missing documents.

Watching television. Perhaps this is not a chore, but many consider television watching a waste of time because of lack of selectivity. Avoid keeping your set running all the time. Through habit you may waste hours watching anything that comes along.

Getting Around

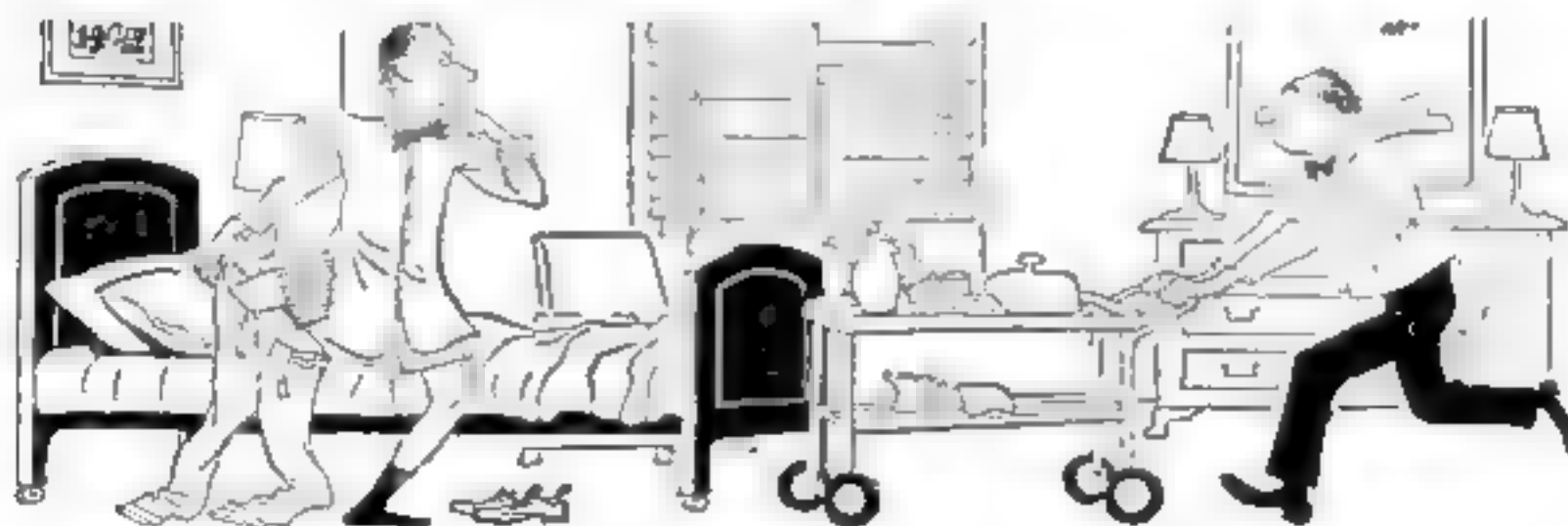
Few communities today don't have traffic delays, parking problems, tie-ups. Whether you travel lots or little, these ideas will help:

Plan your trips. Dr. Norman Vincent Peale, minister and author, is one of the busiest men of our time. He says: "Each minute spent thinking out a trip in advance pays for itself many times over."

Look up schedules *before* departure. Set a kitchen timer for the period you have available. It will help you gain every moment before leaving.

When you dress in a hurry you may forget your keys. Have duplicates made for each suit. Let a little loose change accumulate in pockets—avoid last minute bill changing for tip, phone call, or bus ride.

Saving time while traveling. Make reservations ahead. Check a guide-book. This will tell you the hotels most conveniently located and best equipped to meet your needs. Take advantage of service. The small extra charge for breakfast in your room often outweighs disadvantages of waiting to be served. If traveling with children, check baby-sitter service. If you



BOOK DIGEST: HOW TO GAIN AN EXTRA HOUR

require transportation, let the hotel handle it. This saves calls to offices, the chore of picking up tickets.

Go by air. If rushed, fly by night and sleep in the air.

Save time using your car. Here are tips from the American Automobile Association:

Have your local garage man tune up, inspect. Invariably it's cheaper, quicker to get work done at home than in a strange community. Pack one small piece of luggage to contain all the items you'll need while driving and at rest stops. Put whatever you won't need on the way in storage areas of the car, leaving the passenger compartment for comfort.

Saving time packing. Make a list of things needed for an overnight trip, a weekend trip, or longer. Divide into groups: clothes, accessories, toilet



articles—and leave space to check off. Then you won't overlook essentials. As you pick clothes, collect accessories to go with them—belts, shirt, tie. Take only enough to last the days you expect to be away.

Don't "kill" time. When waiting is inevitable, take advantage of these minutes as reading time. Or sit down and shut your eyes, relaxing as completely as possible. You may even be able to cat-nap.

Charge it to save time. Credit-card services save hours and days in simplified bookkeeping. Many people charge for restaurant tabs, hotel bills, gifts, and other items, get a single itemized bill, and write one check in payment.

Cutting waits. Get to know your barber by name, and make reservations instead of waiting a turn.

Travel agencies will prepare tickets for you if you phone ahead. Some even send them to your home. Don't overlook phoning ahead to pick up items from the drugstore, bakery, or delicatessen.

Car: greasing, repairs can be speeded up if you determine from a prior call to your station when you can get quicker service.

Gaining a Fresh Start

The longer you stick to any task, the more time it requires. Yet you can have a fresh start if you use these techniques:

Beginning your day. My friend Earl Lewis used to follow a schedule of getting up at the last possible moment, gulping down toast and coffee,

then dashing off. His breakneck start left his morning ragged. Last spring Earl determined to get up 10 minutes earlier. After breakfast—he walked around his garden! He's found a constantly changing morning freshener. Ten minutes' reading, playing music, or taking a walk set you off sparked for your entire day.

Getting a fresh start from lunch. The man who takes only time to grab a sandwich is actually cheating himself of a fresh start. It's not only rest and relaxation. Going out for a bite provides a change in scene and temperature, which furthers working efficiency.

Too many of us go through our days with hardly a breath of fresh air. Stop at least once or twice for a quick refresher.

Taking time for quiet meditation is most effective.

Another good idea is to use the last 10 minutes of your day to clear all the day's troubles, leaving your mind free for a good night's sleep.

Cat-naps as timesavers. The late Franklin D. Roosevelt found that a 30-minute nap enabled him to work two hours later every day. Former President Harry S. Truman had the ability to sleep almost anywhere at any time. A 15-to-30-minute sleep gave him pep for two hours' intensive talk.

Take fewer hours for sleep. Try these experiments:

If you're now sleeping nine hours try eight.

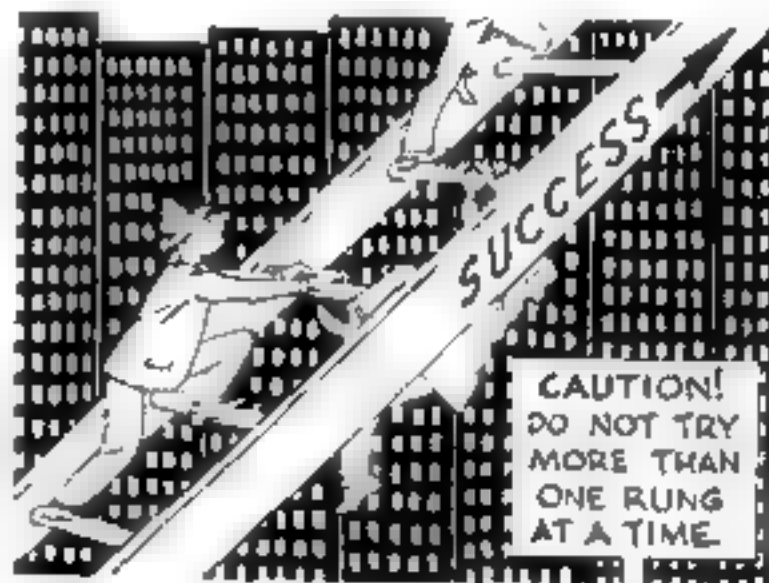
Try setting your alarm at least 15 minutes earlier each day. You can always do more in the morning.

Personal Philosophy and Habits

In these paragraphs, you'll find practical guides to achieve the purposeful attitude of those who have made a place for themselves.

Accentuate the positive. Don't concentrate on breaking old habits. Instead, focus on *forming the new*.

When you come back to work on a Monday morning feeling out of sorts, that's natural. The best way to get moving is to start on routine. You'll soon find you're in full swing. Be content with the small tasks first. If you aim too high, you risk failure just when you need success.



How to concentrate. Good attention is the primary secret of getting things done in less time:

Are you exercising all your wits?

Are you correlating the facts?

Are you forming a picture of what you intend to do and how?

Are you limiting your attention?

Are you seeking for your interest in the subject?

Do it now. There are many ways to lick procrastination

Don't confuse do-it-now with jumping in wildly. Plan things out. Attack

BOOK DIGEST: HOW TO GAIN AN EXTRA HOUR

easiest spots first. When these yield, you gain confidence. Think of the big task as a series of small ones. The assignment won't seem as frightening.

Avoid over-caution. Many people, refusing to act until everything is cleared up, never do anything.

Less talk, more action. Leaving things unsaid that don't have to be said not only saves time but is the key to tact. That extra word, spoken through



a sense of duty, to be funny, or to get attention, can often be a self-defeating time waster.

Overcome useless talk by asking, "Is this really worth the time it will take to say it?" How many time-consuming clichés do you use? "If you know what I mean, between you and me and the lamp post; do you follow?"

Use your subconscious. Set forth exactly what you're after, an idea, or a way of handling a particular task.

Choose a quiet time for concentration. Discipline your mind to dwell on the material.

One of the best times to give a particular assignment to your subconscious is when you're going to sleep.

Forget the whole business until the specified time. Your subconscious will often pop up with exactly the approach you've been seeking.

How to Use the Time You Gain

What do you want out of life? How would you fill your days if you had no work to do? Establish your goal by making up a list *right now*. The time is there, the extra hour, if you know how to make it yours.

Expand all the talents you have. See how they can be amplified.

There's a wide range of community activities in which you can participate. It will be one of the most rewarding efforts you can make.

Hobbies are rewarding. The range is endless: amateur theatricals, art and painting, music, literature, handicrafts, photography.

Millions of people are turning to home crafts. They've found them highly rewarding in richer, happier living.

Developing timesaving ideas useful to others can be highly profitable. Some of the best inventions have been minute-minders—from Brown 'n Serve rolls to the shelves inside refrigerator doors. Your own timesavers can be just as good money-makers.

Make the precious extra hour you gain every day help you realize your dreams for a fuller life now and a richer tomorrow. ■ ■

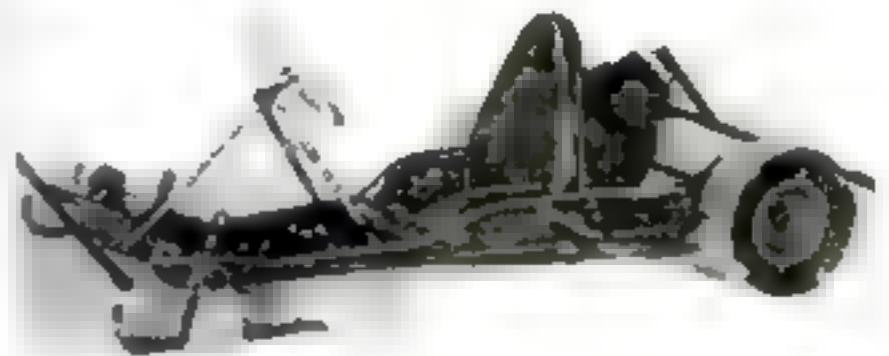


Tow with thrills: An ice kart starts into a turn with a pair of skaters hanging on behind.

Karting on ice: a new winter sport

When freezing weather strikes, racing karts need no longer be put into winter storage. They can be moved over to frozen lakes and ponds.

For conversion from dirt track to ice, the karts are fitted with a pair of steel skis to replace the front wheels and perforated-metal rims to go over the rear tires and provide traction. Norpac Sales Co., Milwaukee, Wis., sells a conversion kit for \$34.95, with rims to fit 10-, 11-, and 12-inch wheels.



SKIS ON FRONT are for steering and antiskid control; perforated-metal rims for traction.

Booklets You Can Get Free to Help You Enjoy Those Extra Hours

Now that you've learned—from the preceding pages—how to gain an extra hour every day, you may want some specific suggestions on how to use your new-found time to get more fun and satisfaction from life. The following booklets are available—free. Order the ones you want through **POPULAR SCIENCE** by using the coupon at right.

1. **Getting Ahead:** How to Succeed Through Home Study
2. **Boating:** Guide to Outdoor Cruising
3. **Electronics:** All About Stereo
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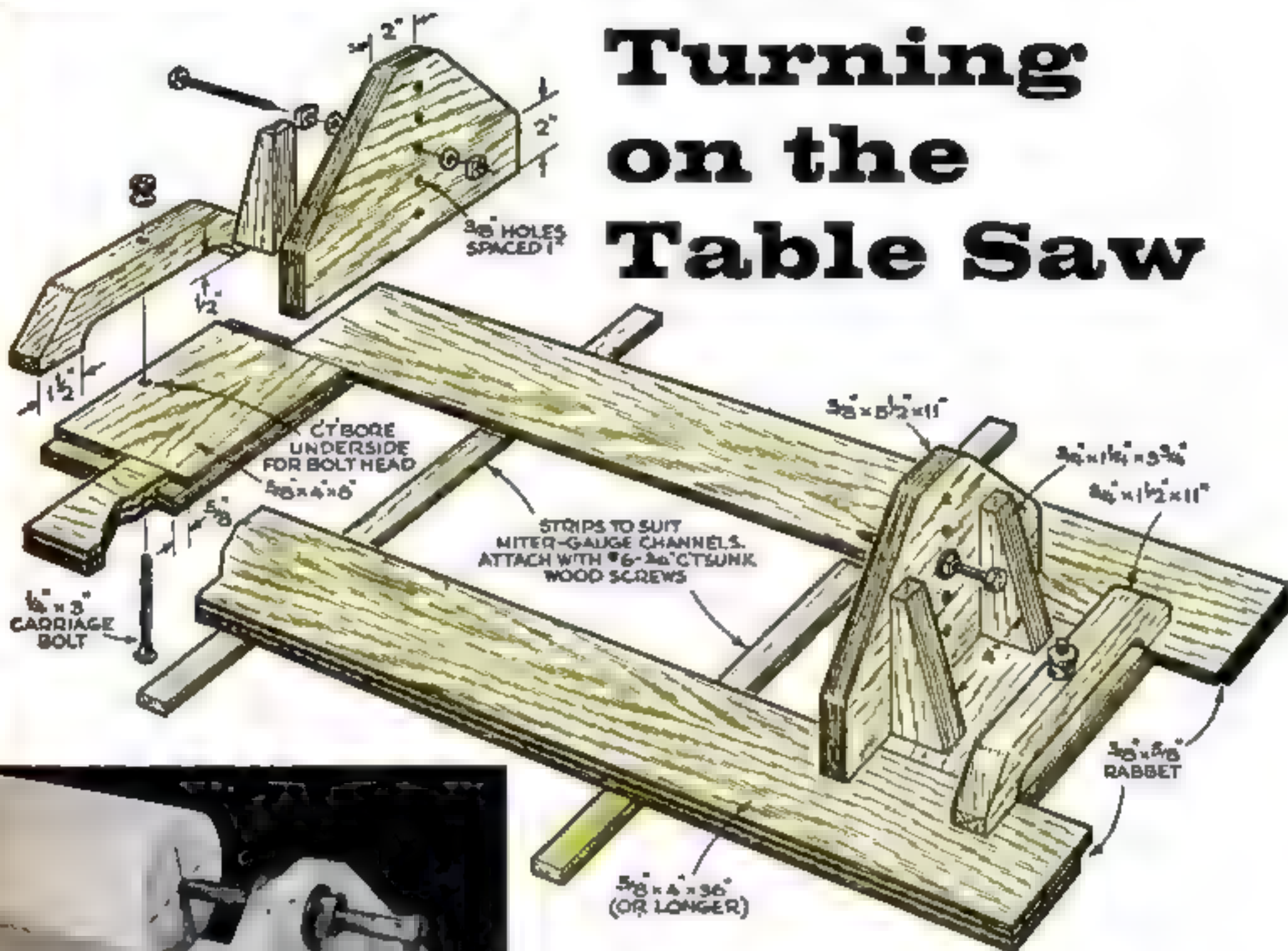
NAME _____

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Paste this coupon on a postcard and send to: **Booklets, Popular Science Monthly,**
355 Lexington Ave., New York 17, N. Y.

Have you been
missing this?

Wood Turning on the Table Saw



THE JIG YOU NEED FOR TABLE-SAW TURNING

BOTH CENTERS ARE DEAD: They're made from $\frac{3}{8}$ "-by-4" machine bolts or cap screws, pointed on a grinder. Two nuts and two washers on each bolt permit considerable adjustment and provide a means of locking the centers in position.

By R. J. De Cristoforo

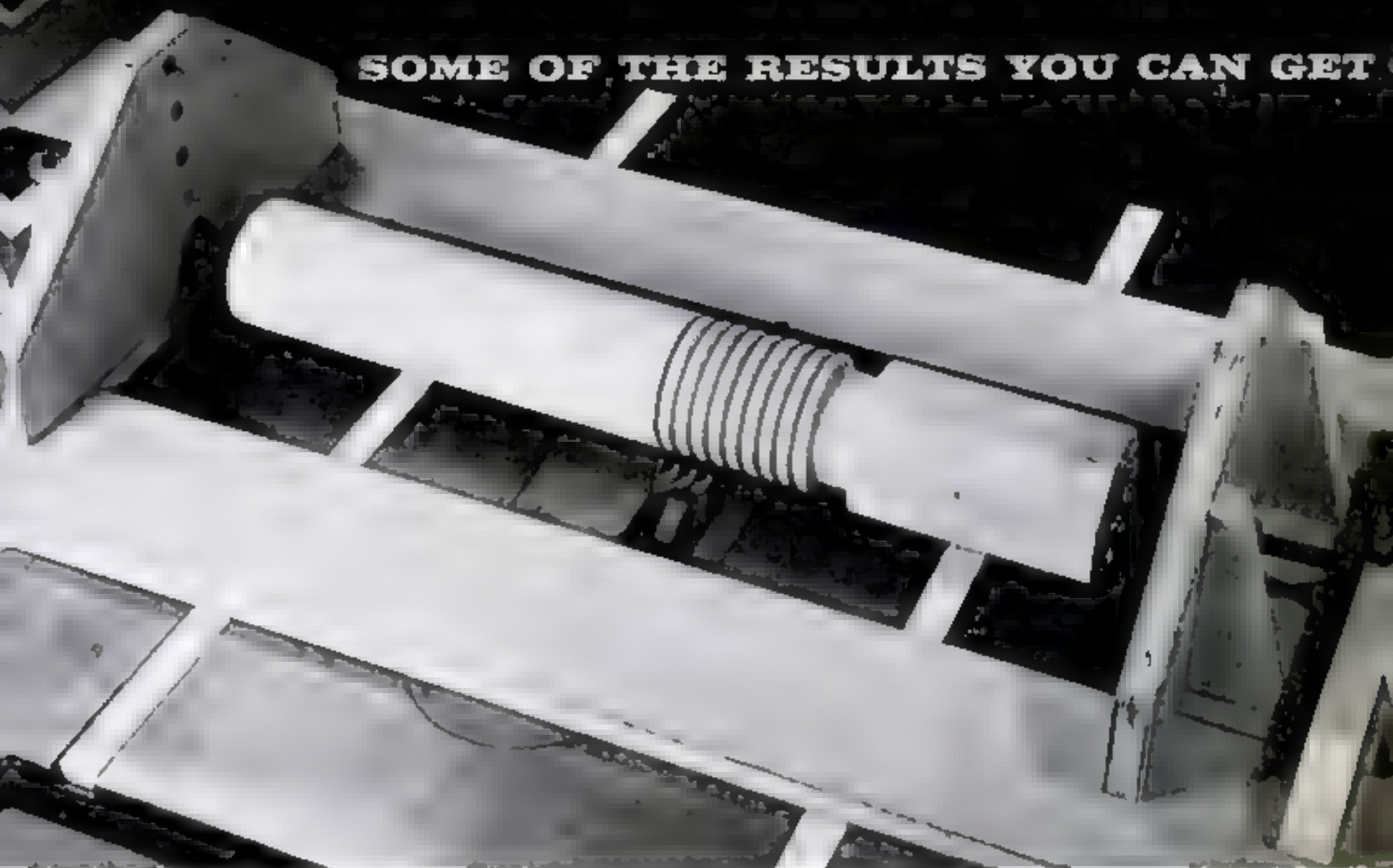
PERHAPS you lack the patience, time, or skill to turn out perfect shoulders, beads, coves, and fillets on a lathe. Or perhaps you just lack the lathe.

In either case, with a special table-saw jig, you can spin a block against an

arbor-mounted molding head to achieve precise profiles that will rival the best efforts of a skilled wood turner.

Your "turning" patterns needn't be limited by a meager assortment of molding knives. By utilizing portions of knife profiles and combining separate cuts, you can extend the basic shapes considerably. You can also use this jig with a dado

SOME OF THE RESULTS YOU CAN GET

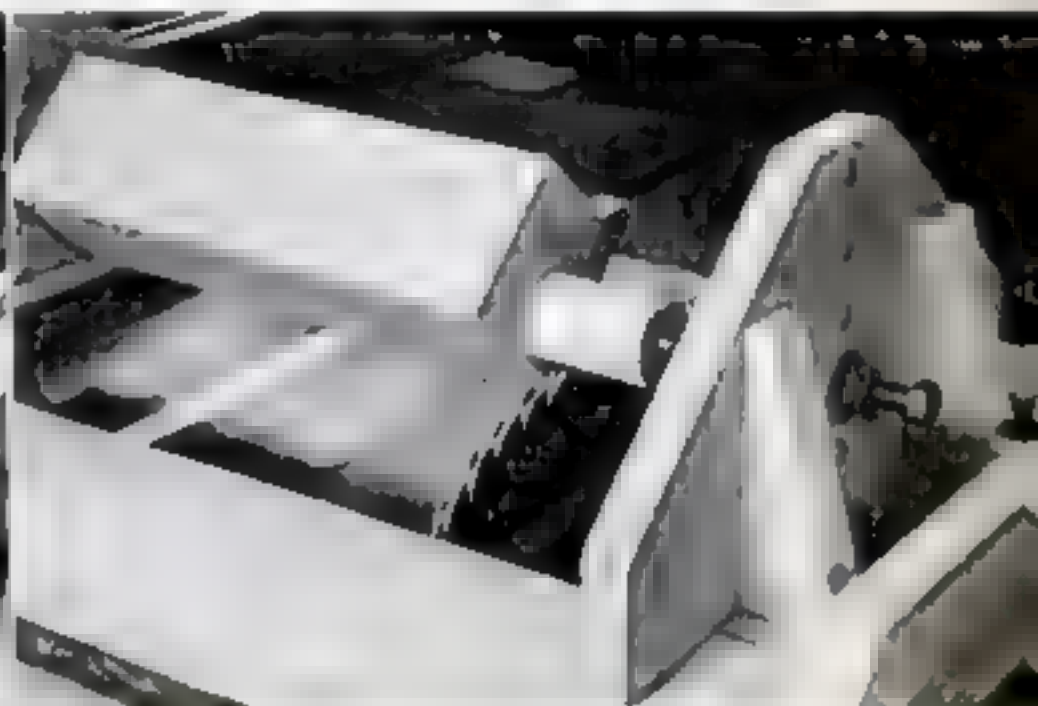


PERFECT BEADS can be machined on a cylinder. Octagonal block was mounted between centers

and rounded with a blank cutter; shoulder and beads were then cut with molding knives.



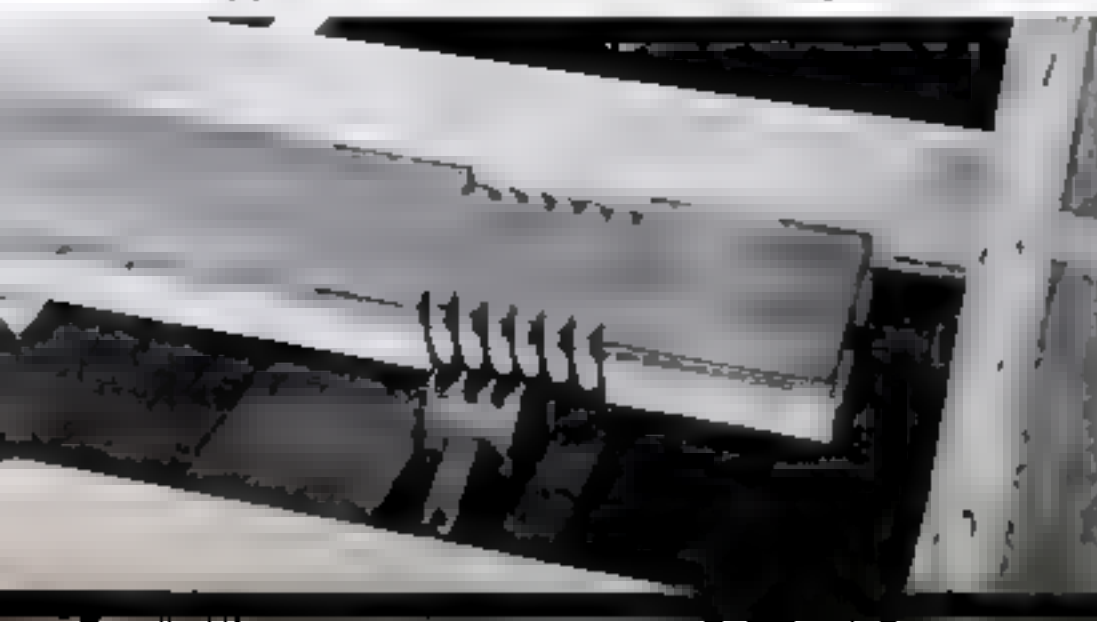
ROUND TENON on square stock can be formed by means of repeated passes over a regular blade. A dado assembly will cut it faster.

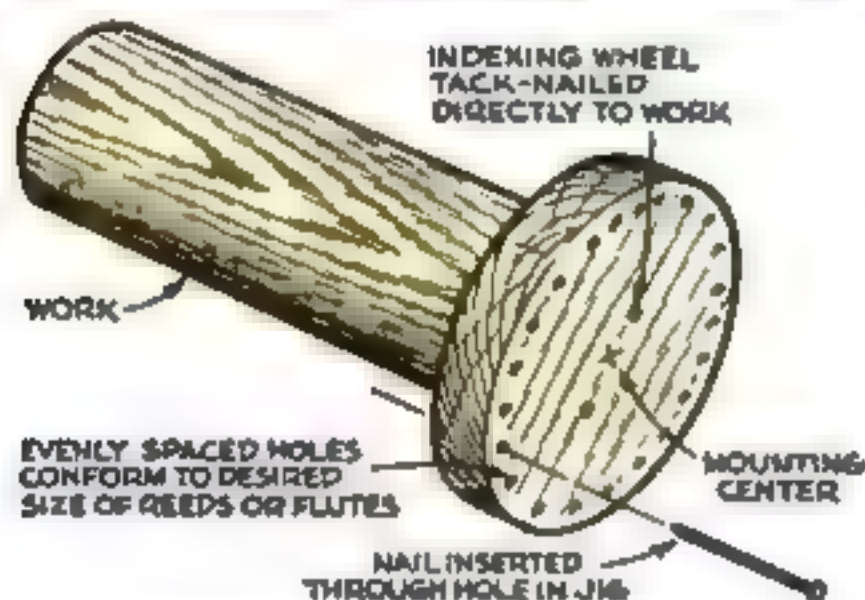


OFFSET TENON requires same technique, but work is mounted off-center. Ganged blades may be used as substitute for dado assembly.

EDGE SHAPING on a rectangular block can be left as decorative touch, or the edges can be ripped off to make half-round, shaped molding.

TAPERED LEGS or spindles are turned just as they would be on lathe—with a true center at one end and an offset center at the other.





FOR PRECISION, tack an indexing disk to one end of cylinder before mounting. Nail inserted through jig engages successive holes to space cuts and keep work from turning during pass.

assembly to produce cylinders from square stock and do many other jobs.

Single or ganged saw blades will cut their own shapes. You can even combine items (a dado assembly and a saw blade, for example) within the limits of the arbor for multiple-type cuts. With saw blades or thin dado assemblies, you can make deeper cuts than should be attempted with any shaped knife.

Other advantages of table-saw turning: You can handle almost any size cylinder as long as the jig is enlarged to suit. Blanks of a size that could vibrate a small lathe right out of your workshop can be handled with confidence on this table-saw setup. The difference: In the jig, the work remains at rest; it's the

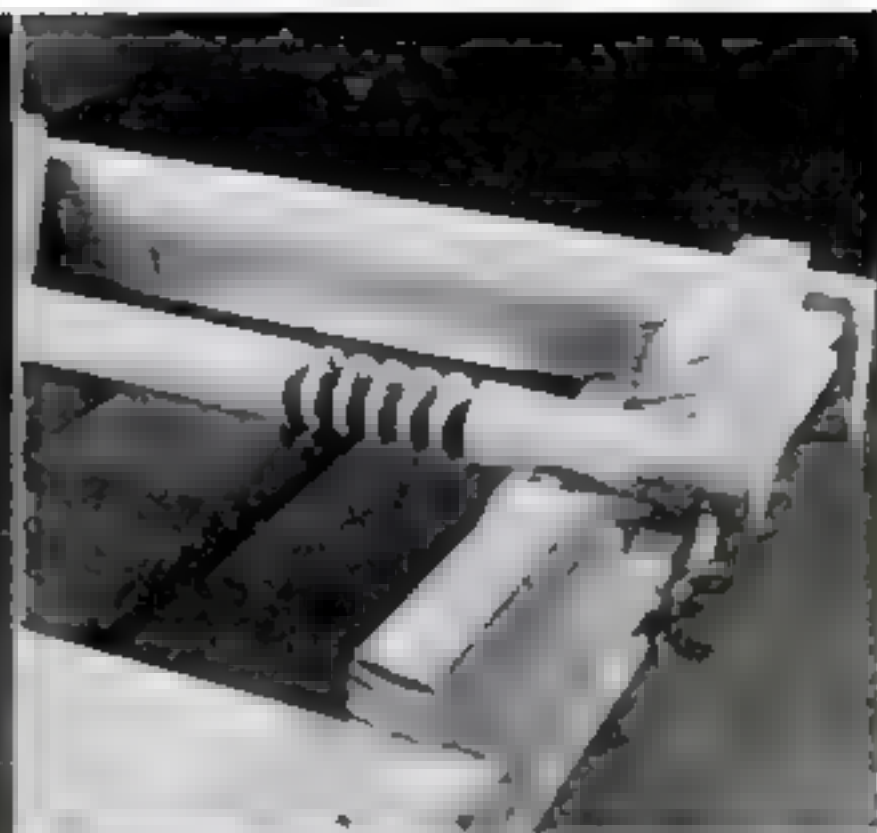
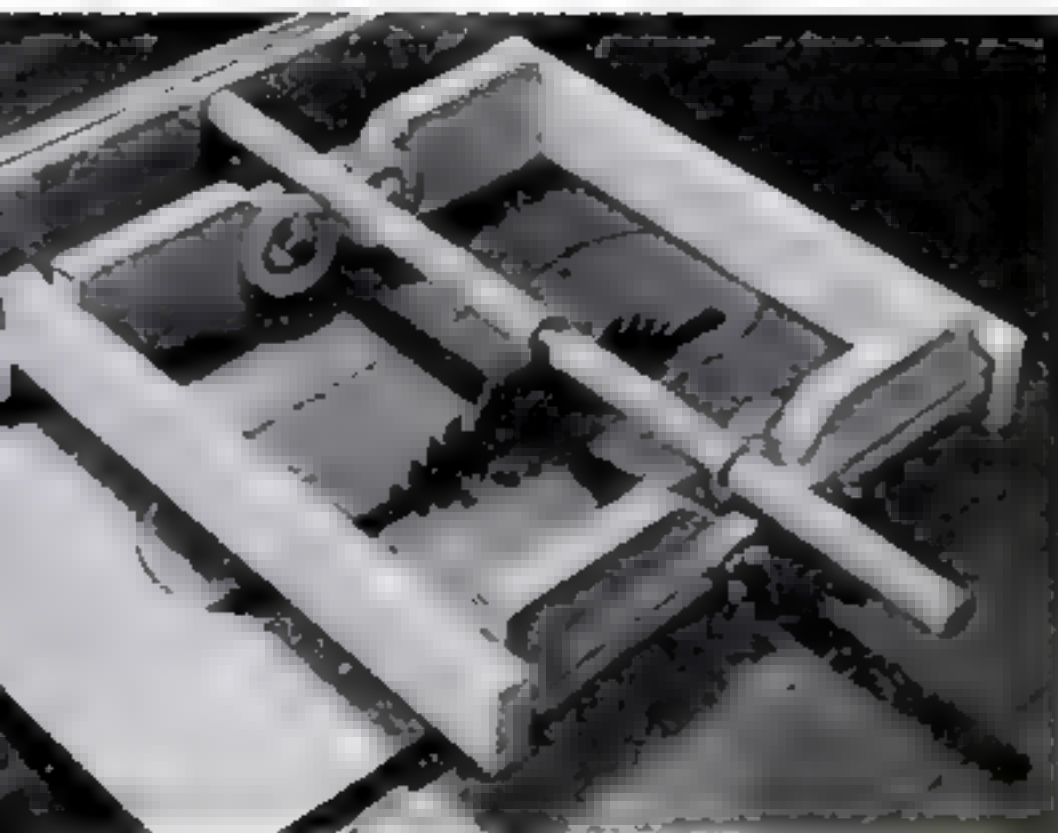
FLUTING AND REEDING are done with miter-gauge strips removed so jig can be run along fence. Hand-hold cylinder and judge spacing by eye, or attach indexing disk (sketch, left).

cutter that spins. And by butting the jig against the rip fence, it's easy to use the fence as a stop for duplicate cuts in several pieces or for precise spacing between cuts.

Here's a safety rule (it holds for any kind of shaping): Don't try to cut too deep in one pass. Lower the cutter below the table surface and, after the work is mounted, raise the cutter slowly until the cut is about $\frac{1}{8}$ " deep. Then rotate the work slowly against the direction the teeth are spinning, keeping your hand away from the cutting area. When you've completed one rotation, raise the blade slightly; then deepen the cut until you get the shape you want.

How about finishing? After shaping his work, the lathe turner can sand and finish it right in the machine. You can accomplish the same thing in this jig if you make an accessory friction gear. This can be a simple $\frac{1}{2}$ "-plywood disk edged with liquid rubber. Mount it in the arbor like a blade and raise it until it contacts the work. When you turn on the motor, this wheel spins the work while you hold sandpaper or a finishing pad against it.

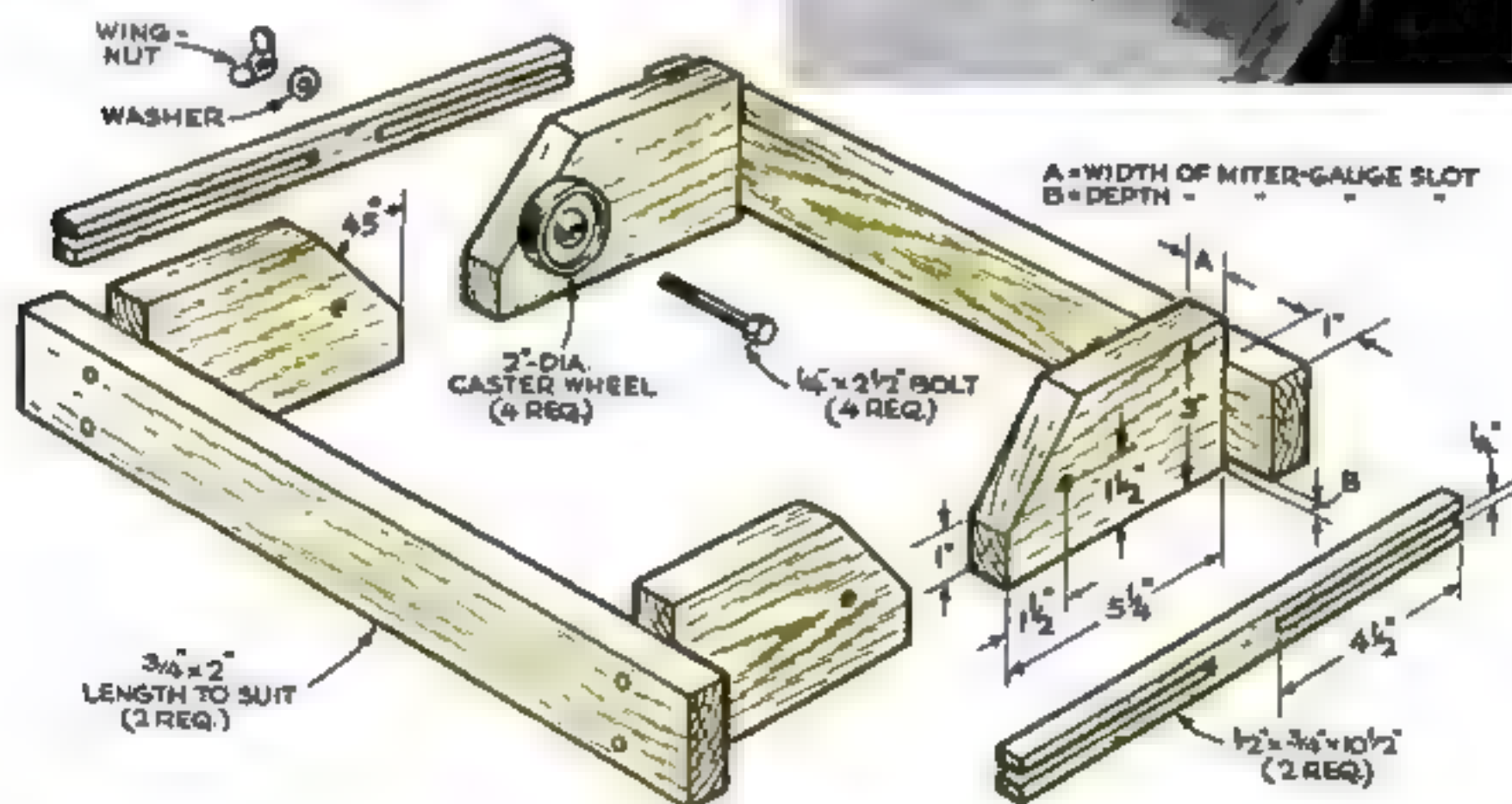
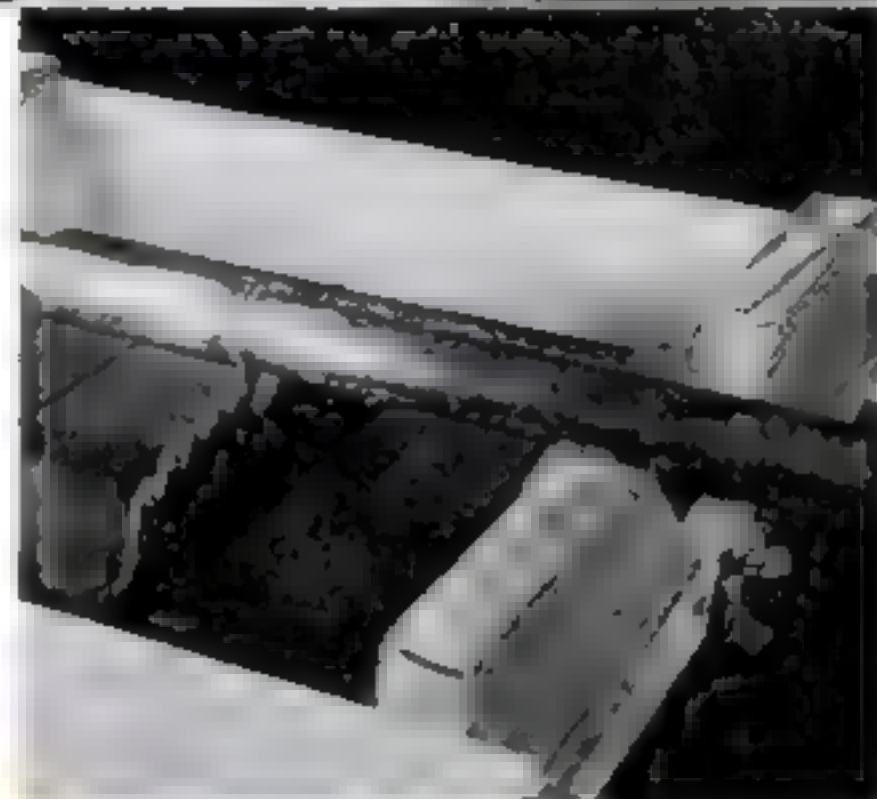
This trick is not possible with the second jig, of course, since the small-diam-



USE THIS JIG FOR TURNING

SMALL DIAMETERS

UPSIDE-DOWN-TROLLEY version of larger jig is for use with small-diameter stock. Dowel-like cylinders would whip in a lathe, but here they are slowly hand-rotated. Jig rides in table slots, uses rip fence as stop (above, left). Duplicate cuts (above, right) are made by lowering work onto preset cutter, adjusting fence after each rotation. With carbide-tipped blade, you can make light cuts on nonferrous metals (right) for decoration or size reduction. Use regular blade for do-it-yourself aluminum.



eter work is only cradled between the wheels and is not fastened in the jig. The technique of using this jig differs in other respects, too. Work can be set in place behind the cutter and held down at each

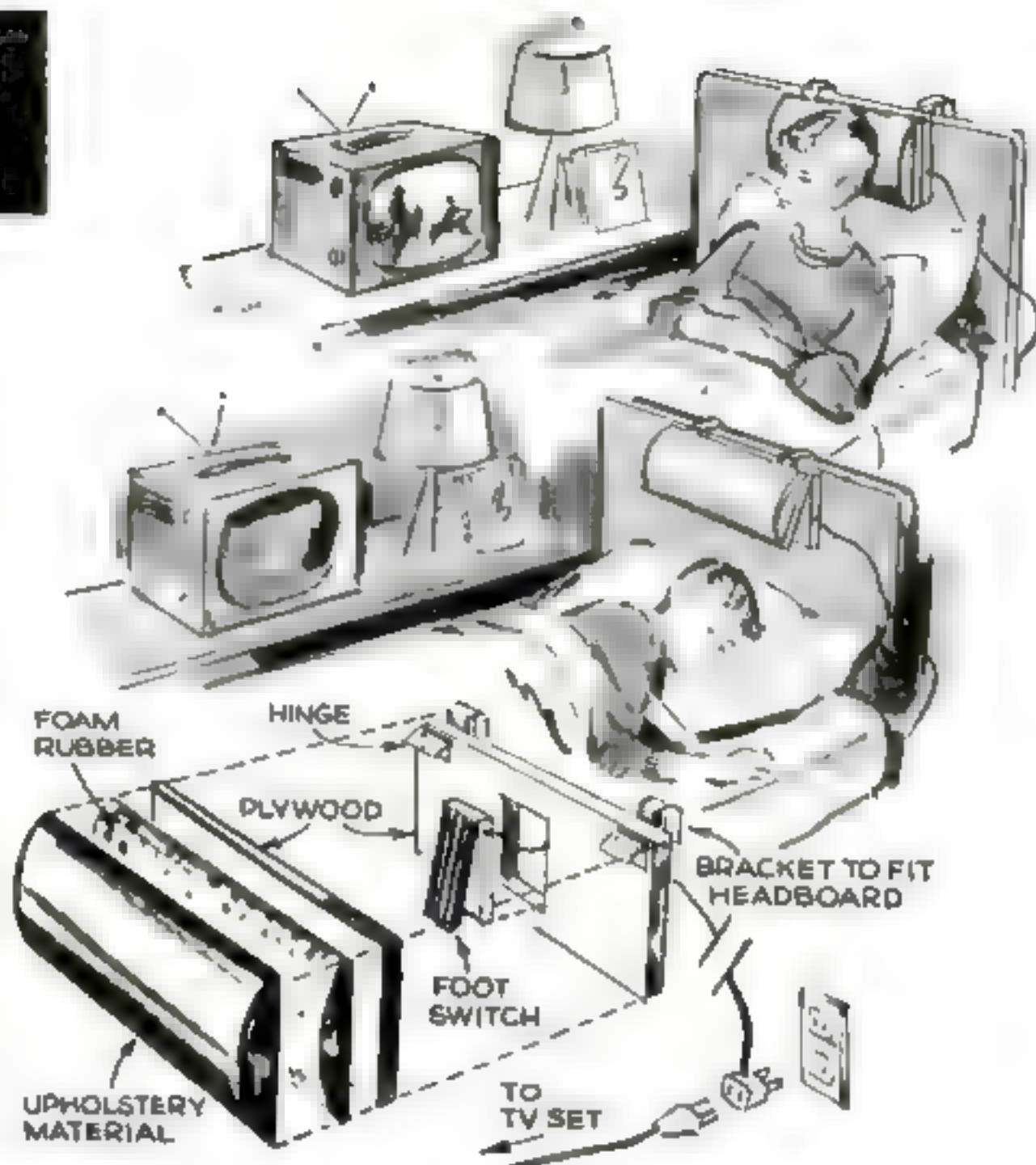
side while the entire jig is pushed forward into the revolving teeth. This procedure is particularly useful when the cutter is tilted. Since the work is easy to turn, wheels needn't spin freely. ■ ■

Short Cuts and Tips

FROM PS READERS

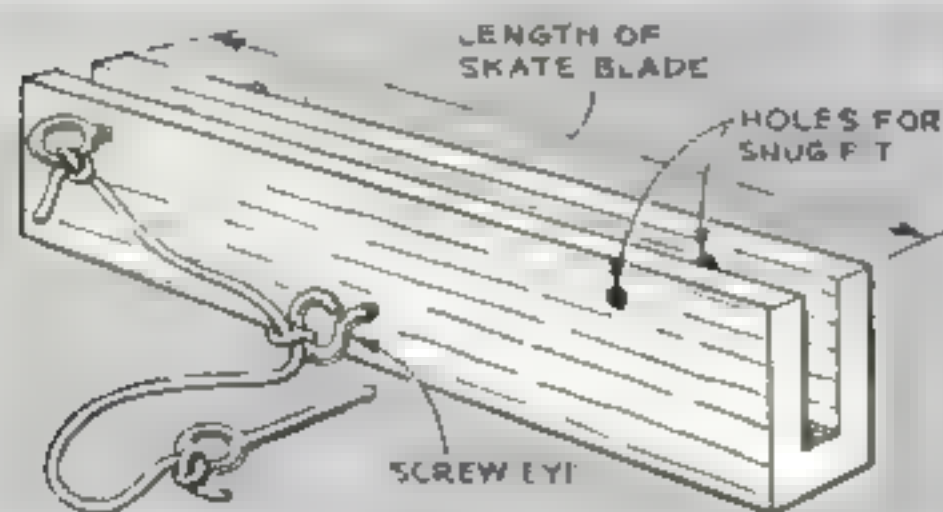
Headrest Turns Off Bedtime TV

Does bedroom television put you to sleep before you can shut the set off? My youngster used to move our portable next to his bed, then drop off and let it cook all night. I made this automatic turnoff from a dark-room foot switch and bracketed it to his headboard to serve as a headrest. As long as it's depressed, the set stays on. But at the first nod, the show's over.—*Herb Pfister, Glen Head, N.Y.*



Guards for Ice Skates

KEEP skates sharp by sheathing the full length of each blade in a guard block. Using a dado blade on the table saw, cut a slot deep enough to let the block slip up against the shoe sole. The insert pins lock the guard on; so they don't get lost, tie them on short strings to a screw-eye driven into one side of the block.—*David A. Cleary, Fargo, N.D.*



To remove this SAVE-IT SECTION...

... Pinch the eight pages together and lift firmly, tearing them free from one staple and then the other. When the section is free from the magazine, staple it along the back fold and crease a strip of tape over the spots torn out by the staples.

Next Month: Part II of "The Fine Points of Making Chairs"—a discussion of metal chairs.



By

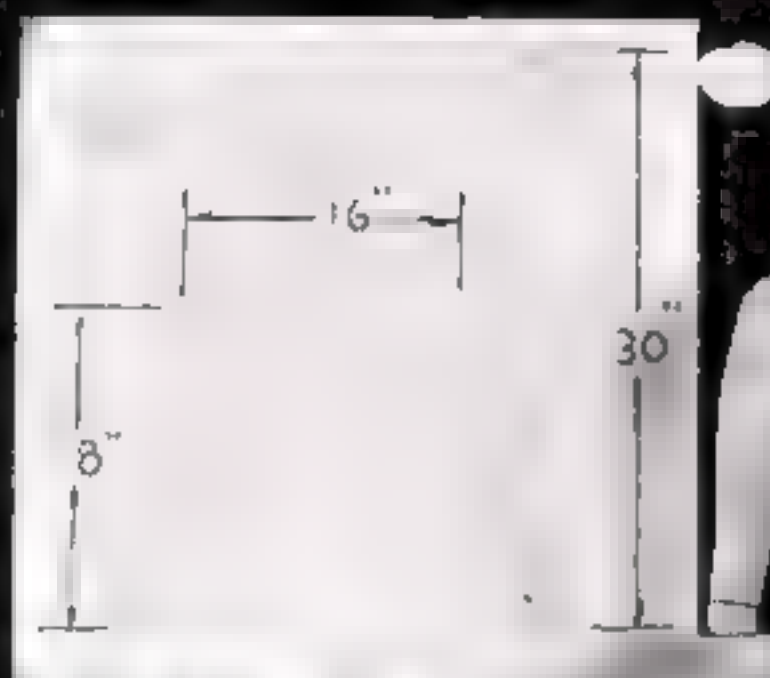
R. J. De Cristoforo

A LENGTH of two-by-four and about $1\frac{1}{2}$ square feet of plywood is what I brought home from the lumberyard when my wife requested a chair for her typing table. The raw material was not impressive. But despite her ribbing I went ahead and produced a chair that left her pleased and comfortable.

There's a chair-making lesson in this. I'm glad I learned it. This kind of project, especially when required in quantity, has always brought to my mind visions of an endless and dreary routine of duplication. It just isn't so—not if the style is modern and simple and you design it for the job it must do.

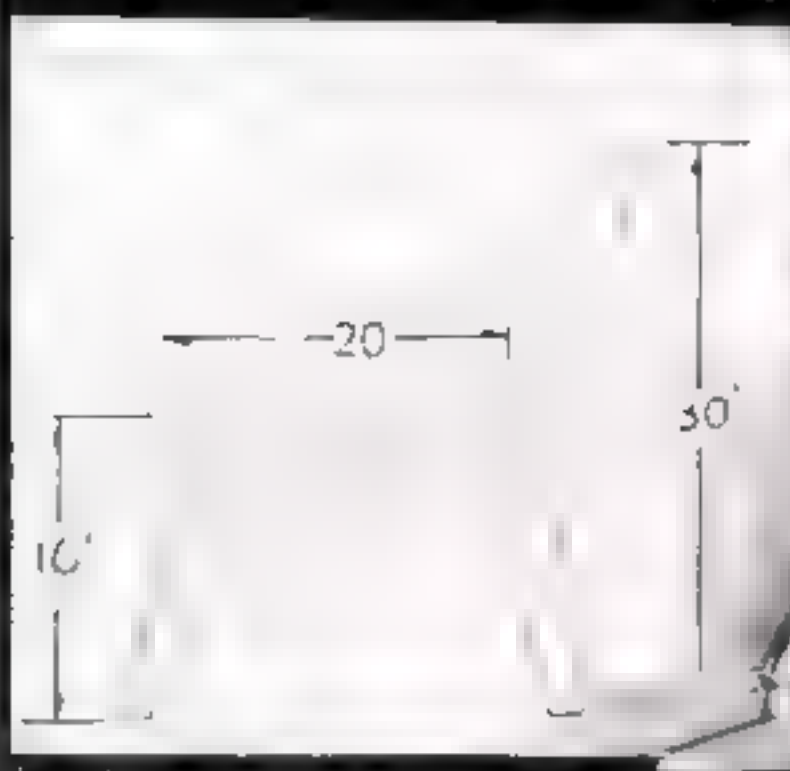
Chairs are for sitting, whether to work, rest, or eat. The designer of a chair you buy builds it for the average person. Likewise, chairs you make must stick to standard dimensions (give or take an inch or two) if you expect to suit persons other than yourself. This is especially true of utility chairs used for dining. A tall person might appreciate a seat several inches higher than normal since it would suit his leg length.

CHAIRS FOR TABLES AND DESKS have the most rigid dimensional standards. Seat width is 17" or 18". The body is supported upright.



The Fine Points of Chair Making PART ONE

CHAIRS FOR RELAXATION—whether they have arms or not—have lower, deeper seats, generally slanted back. They're wider, too: about 20".



Basic plans for 3 chairs

But at a table he would scrape his knees on the rail.

Standard dimensions, however, do not limit design—look around any furniture store for proof of that. Height of back, shape of leg, size of seat, and slope of arms can all be used effectively even though you're working within the limits imposed by necessary standardization.

Side (or "eating") chairs are usually more severe because (as I keep telling my sons) you're not supposed to slump or droop at the table. Arm (or "resting") chairs permit a more relaxed attitude. Here, seats can be lower and deeper. This is a psychological aspect of chair making that can be tested by examining your own reaction to chair types. In a dining chair you sit up straight and proper; in an armchair, even one without upholstery, you're more inclined to relax.

A chair gets tougher to make as you stray from straight cuts. Unless you're a near-expert at turning (and love it), stay away from round legs and arms and spindle backs. Imagine the work needed to make six or eight chairs!

This doesn't mean you shouldn't use round legs. But don't make them. Attach ready-made ones to your framework. This makes economic sense, too. It's almost impossible to make such items as cheaply as you can buy them.

The severity of straight lines can be minimized with pleasing angles and with bevel cuts to remove edges. And it's amazing how you can change the appearance of a piece merely by rounding off all edges with a router after the parts have been shaped.

We used a router on one chair after it had been completely assembled. The stopped router cuts, since we couldn't work close where parts joined, merely produced a decorative detail. But you are not limited to rounding off edges. Router bits are available in many designs, and can make shaped edges if you desire.

Chairs take a beating, so joints must be strong. Butt joints are fine if reinforced with a good glue and dowels.



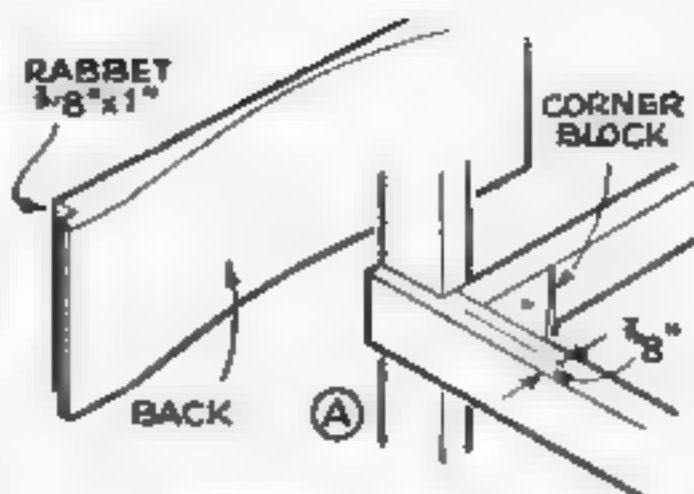
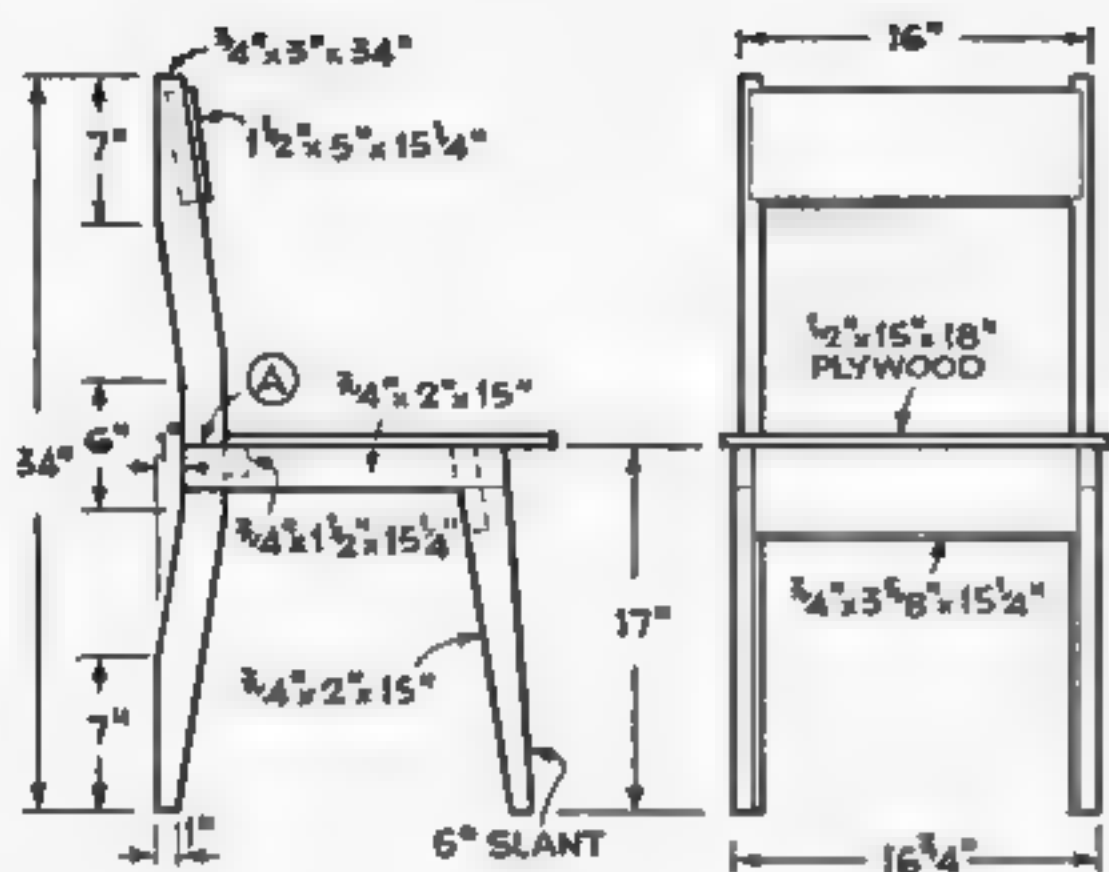
SIDE CHAIR



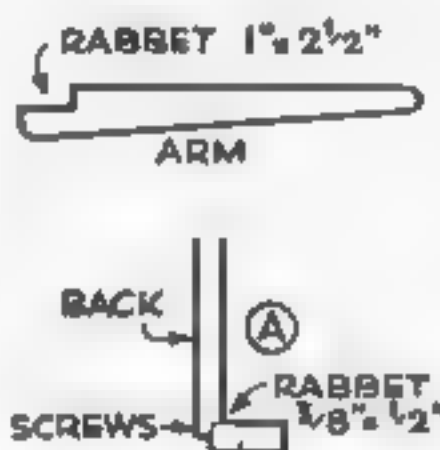
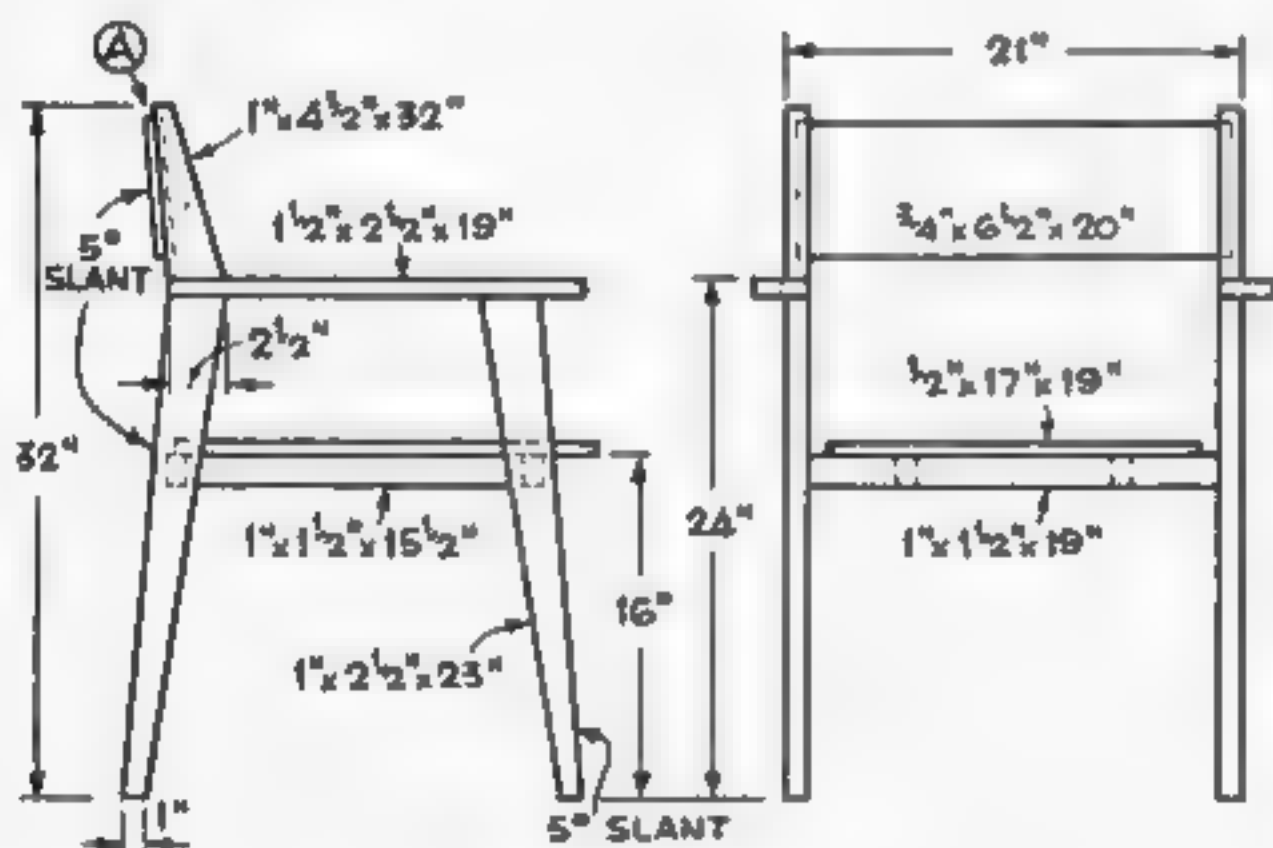
ARM OR HOST CHAIR



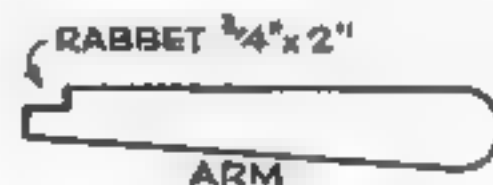
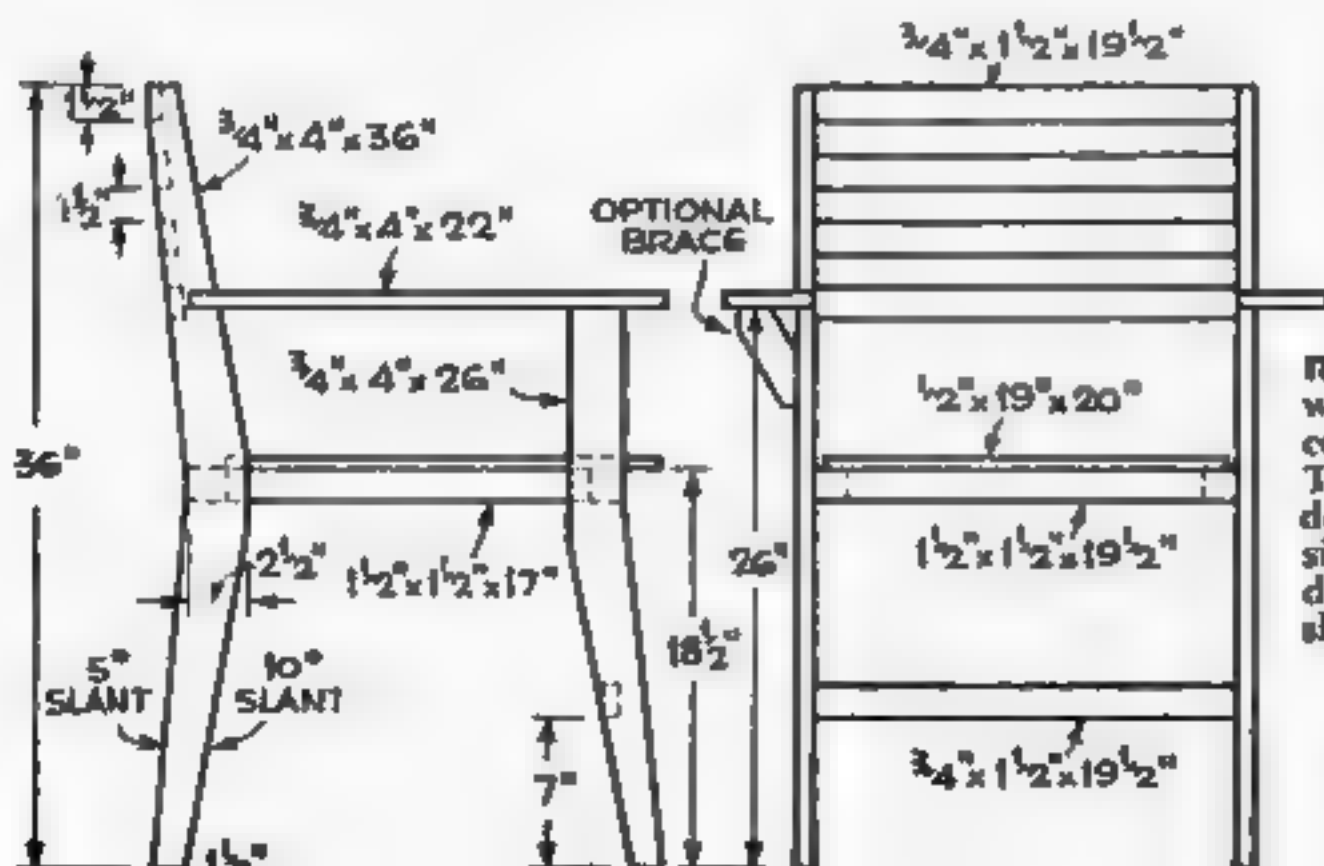
KING-SIZE CHAIR



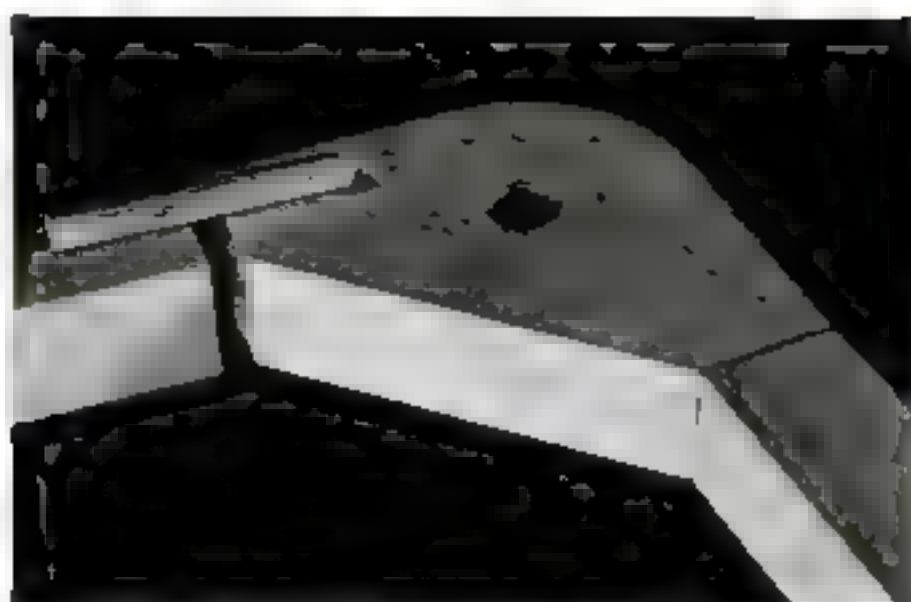
DESIGNED FOR A TYPIST, this chair is easy to duplicate for dining. Shape a 34"-long two-by-four, then slice it apart to form two back legs. Split two-by-fours, too, for front legs and seat rails. Bandsaw curve in back slat.



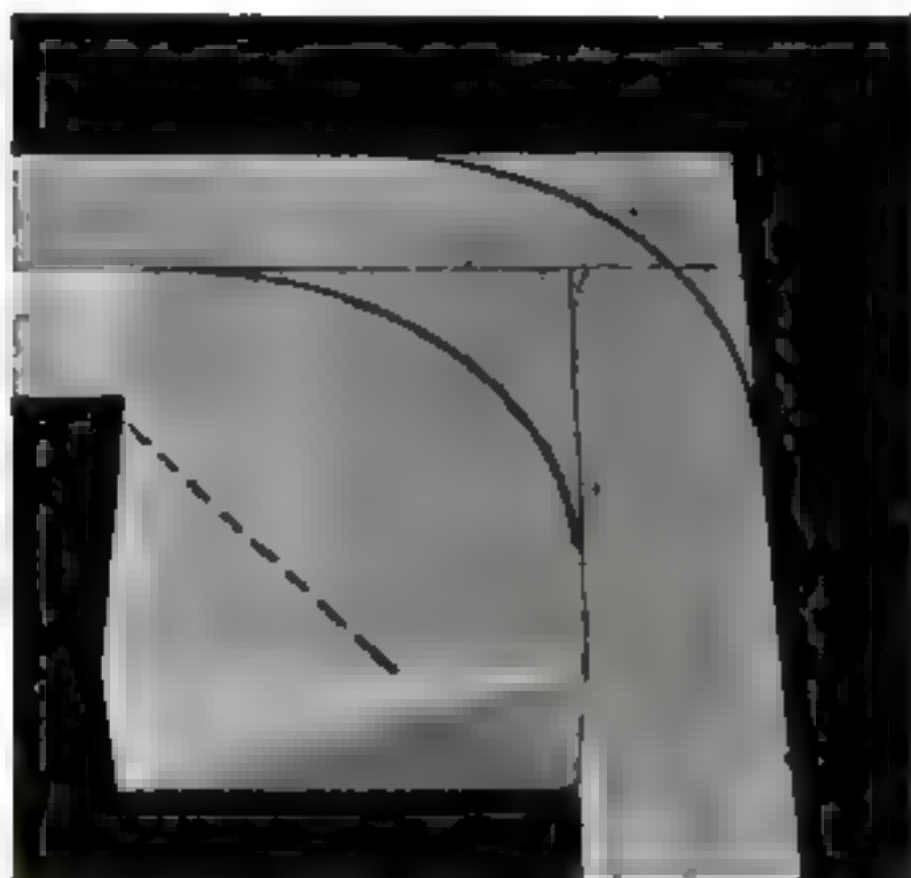
FOR DESK OR TABLE, also, this armchair is deeper, wider, lower. Dining sets now often have only one, so "production" design isn't required here. Seat board can be moved a bit forward if seat and back are padded.



IT LOOKS FINE ALONE, but would be out of place with conventionally sized pieces. This throne is specifically designed for a 190-pound six-footer, is intended for den or study. User might skin his knees at a table.



PRESHAPED CORNER BLOCK, set between seat rails with dowled joints, simplifies corner-rounding. Here, dowel lies atop open joint to show length. Hole in the block is for a leg tenon.



Here's one simple procedure we tested:

Cut all parts of the chair to size. Assemble, using glue and finishing nails. Then drill through mating parts for reinforcing dowels. For more strength, slot each dowel and drive in a wedge. Nail heads are concealed with wood dough, the dowels sanded flush.

This method eliminates precision drilling. You'll have to live with exposed dowels. But under a stain they are hardly noticeable; and paint hides them completely. Or you could make the dowels obvious by using a contrasting wood.

Screws may be used if confined to hidden areas; for example, you could drive them from the inside of the seat frame. If they must be used on the outside, or if you use bolts for a leg assembly, counterbore the hole to hide the fastener with a wooden plug.

The slant of the leg has much to do

Turning a corner

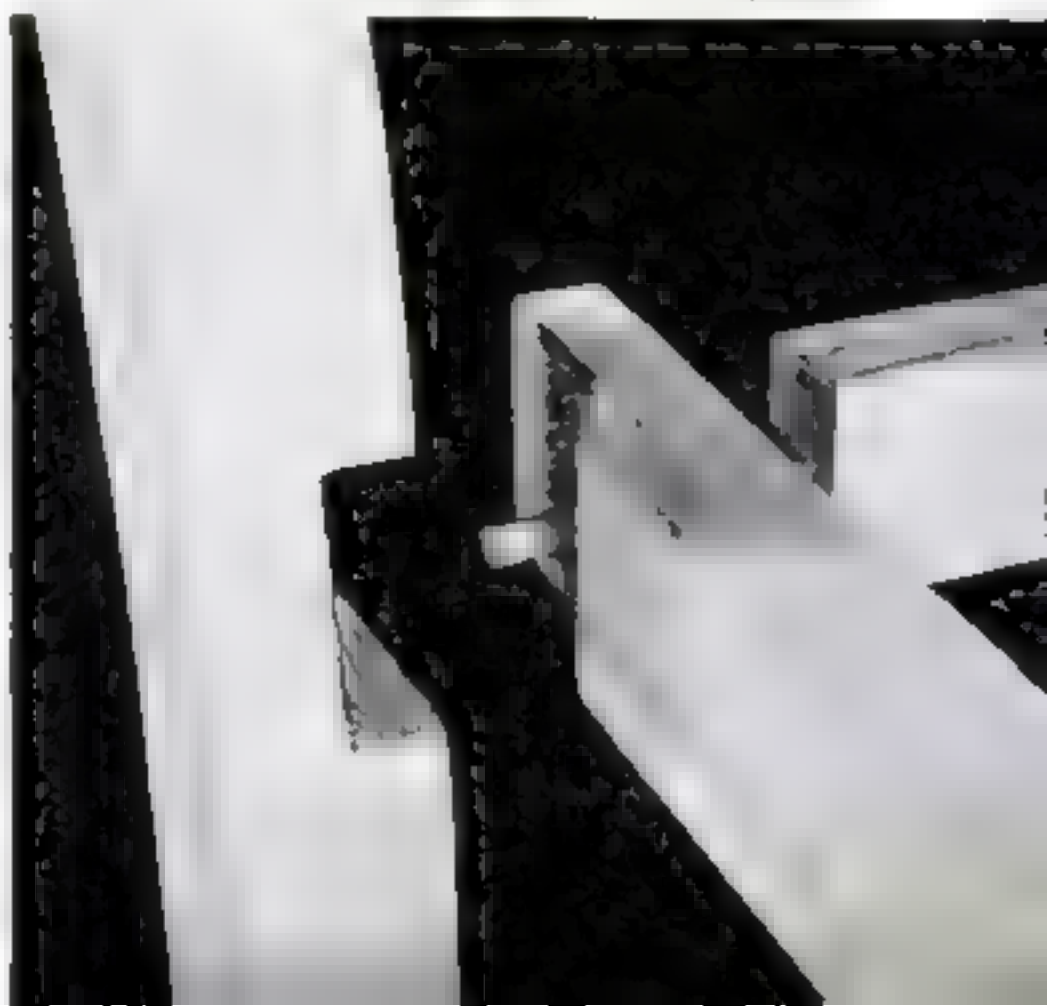


TENON-AND-SLOT VARIATION is strong enough for corner joint on arms or top of back; also, to form frame for canted or webbed seats. Cut slots and trial-assemble before laying out curves.

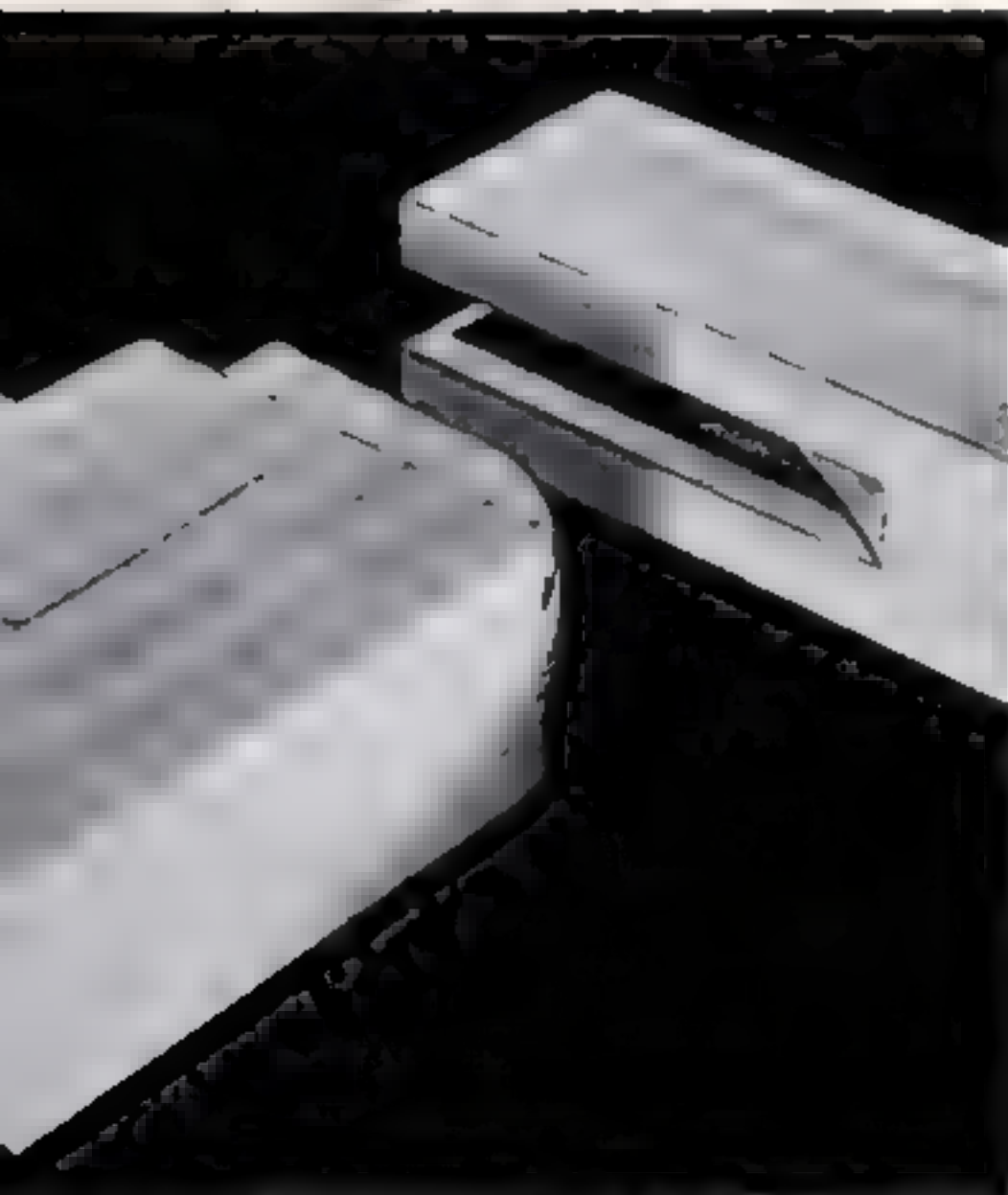
INSIDE CORNER BLOCK should be glued in place before shaping is attempted. Dotted line indicates alternate inside cut if seat board or ready-made legs are to be attached

The chair design

DOWELED T-LAP JOINT notches side rail into rear leg member. Dowel passes through tongue of rabbet and into end of butted back rail to do double duty. Use ample glue and clamp tight.

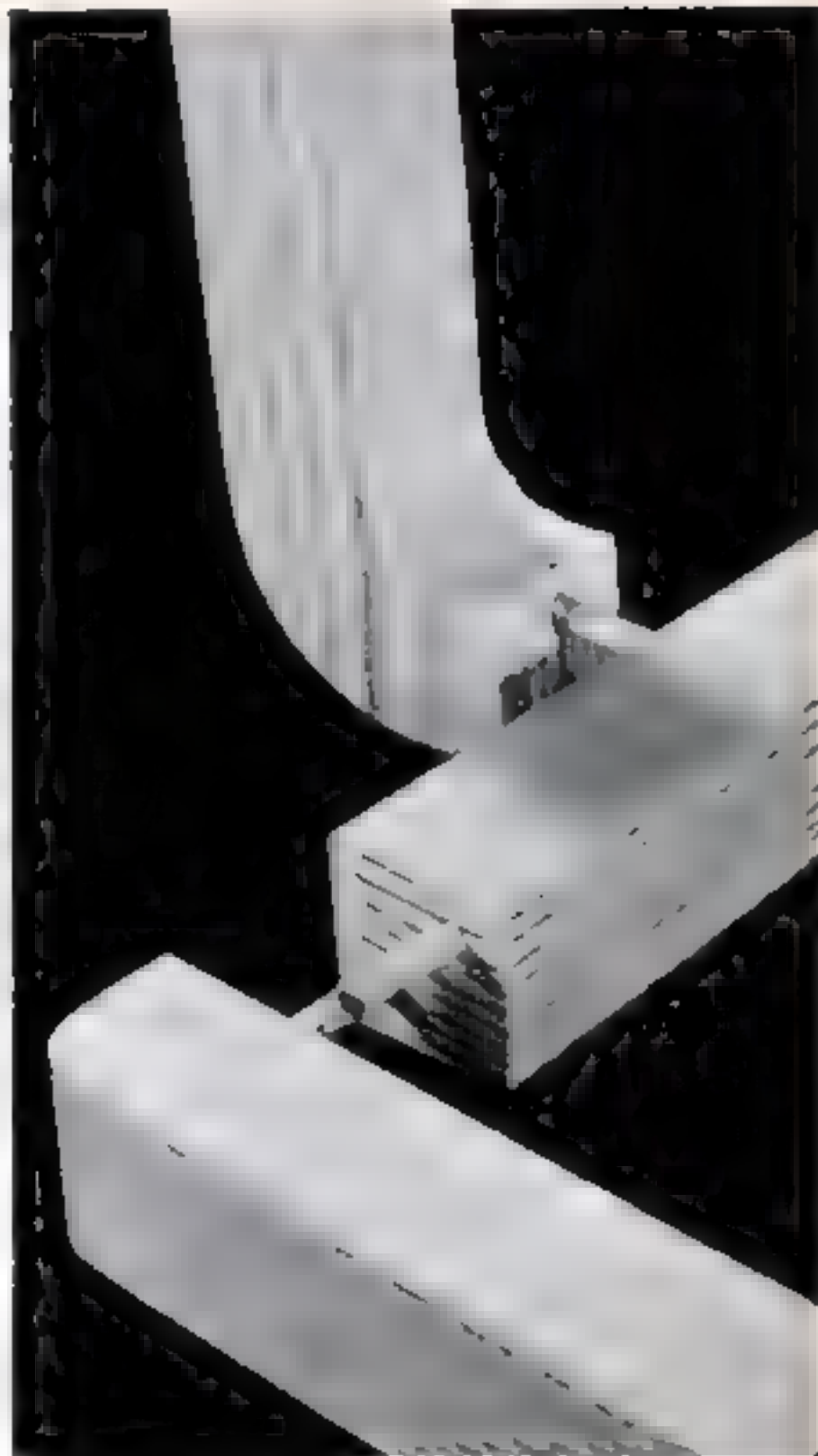


Strong joints don't have to show



SEMI-BLIND-TENON SLOT can be cut on table saw in repeat passes—or with a dado assembly. It's easier to shape the tenon to fit the curve of the blade than to chisel the slot square.

TYPICAL FRAME ASSEMBLY uses dowels to join seat rails and arm member. Corner block is added after joints are drawn tight. Arm curve makes chair wider without broadening seat.



dictates how legs are joined to frame

SINGLE BOLT SECURES LEG to inside of seat frame, if leg is flanked with glue blocks. It's a familiar treatment for front legs, or for backless benches with upholstered seats.

HOCKEY-STICK LEG is the simplest—but not the strongest—type to attach if seat is a solid panel. Avoid too much slant, and be sure to provide extra bulk within area indicated.



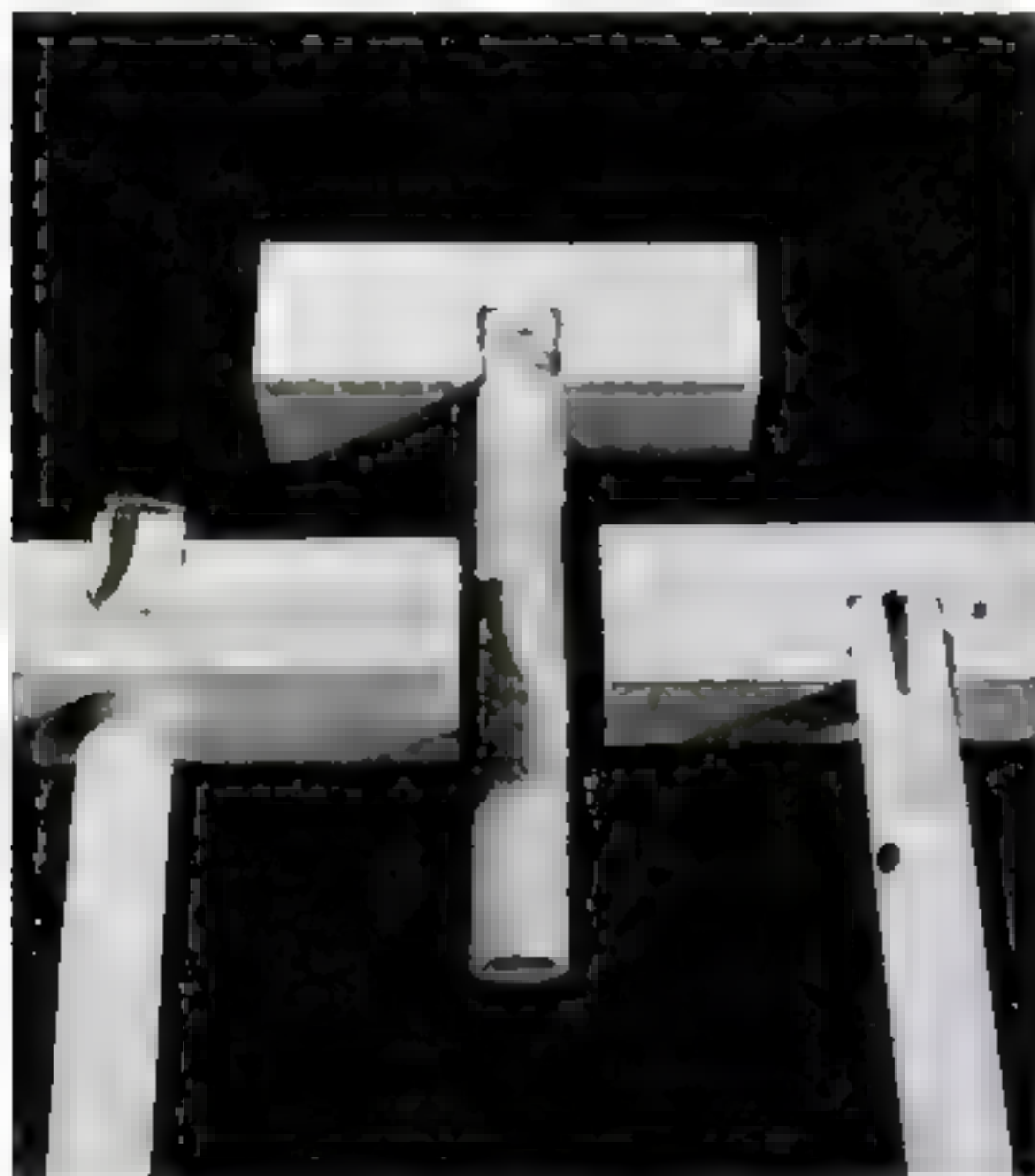
Use dowels for strong joints



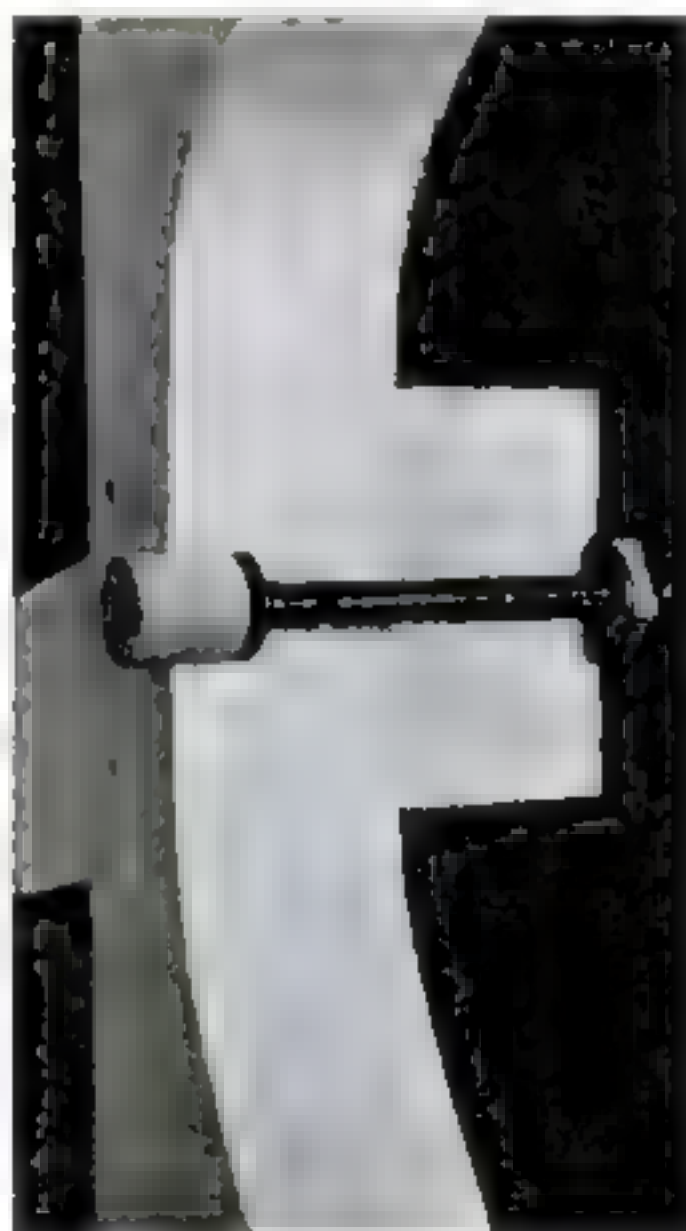
IF DOWEL NEEDN'T BE HIDDEN, drill hole for it after assembling parts with glue and finishing nails. This gives perfect mating. Keep drill perpendicular to the surface of the top piece.



SLOTTED DOWEL IS STRONGER: Cut piece $\frac{1}{2}$ " too long and slot 1" of end. Put glue in hole and drive dowel home. Fill slot with glue and drive in wedge. When glue dries, trim flush.

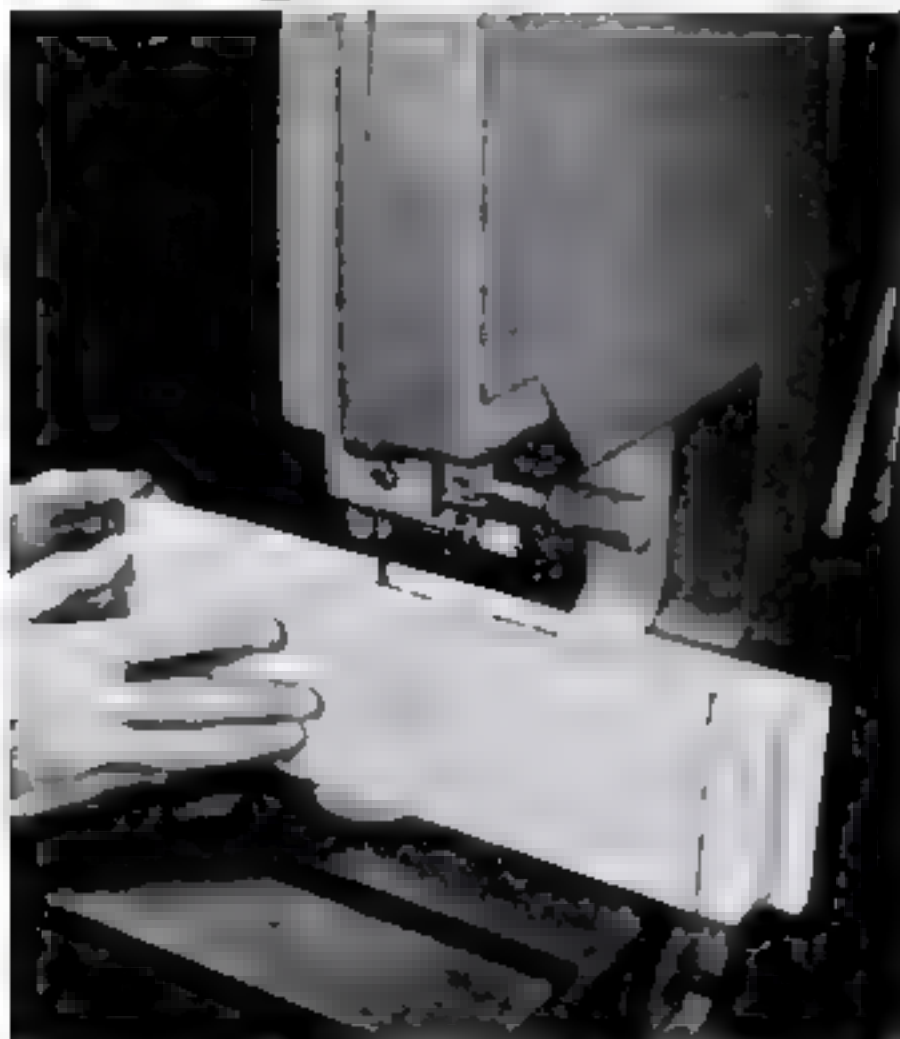


SLICING INTO SOCKETS shows three methods of locking dowels or round leg tenons. Left: exposed wedge. Center: second, smaller dowel driven in through side of mortise to pierce tenon. Right: concealed wedge in slotted dowel.

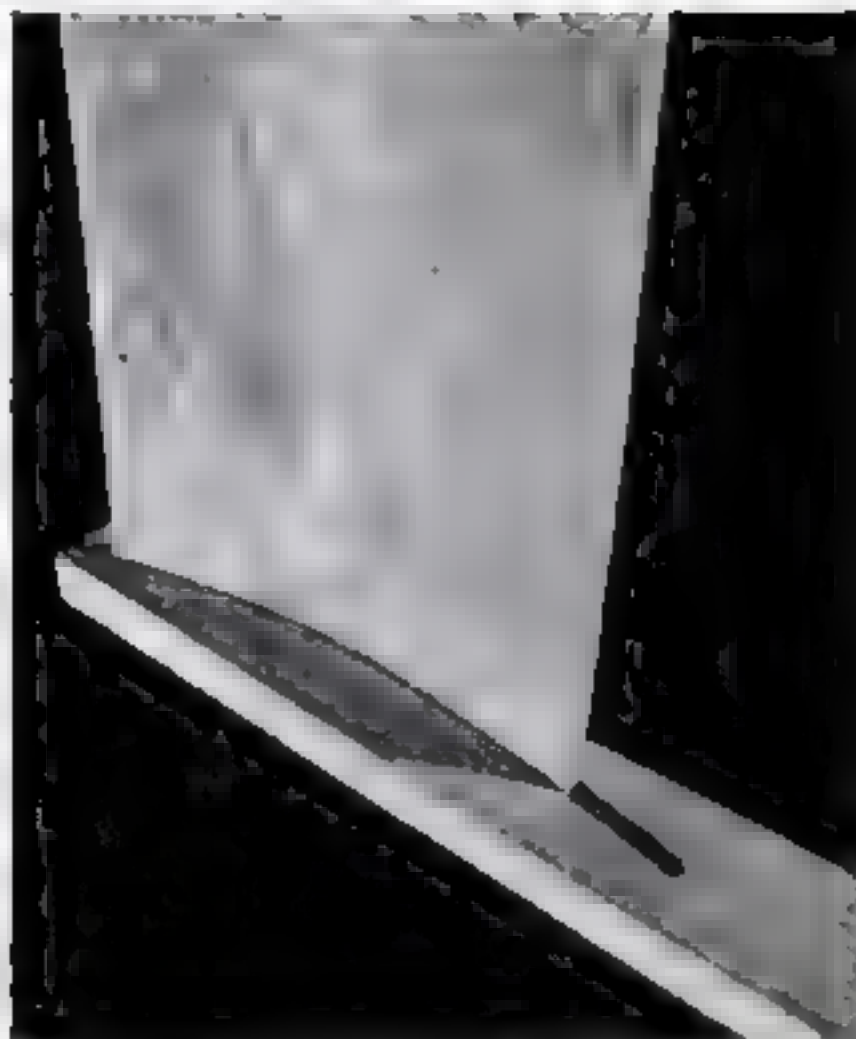


DOWELS SERVE AS WOOD PLUGS when bolts must be used. Counterbore to recess head about $\frac{1}{2}$ ", as cutaway shows. Carriage bolts are best; the square shoulder seats so bolt can be tightened even though head is out of reach of pliers.

Four professional short cuts



WHY CARVE A CONTOUR when you can cut it on the bandsaw? Use widest blade that will make the turn. If radius requires narrow blade, cut slowly to keep blade from bowing in the cut.



TO BEND NARROW PANEL of $\frac{1}{4}$ " plywood, as for a concave back, curve a stopped groove into each side member with a router and force the panel into place. Wood strip plugs top slot.



DOUBLE-PURPOSE CORNER BLOCKS not only strengthen frame but provide means of attaching seat board. Bore clearance hole through block; lead hole into bottom face of plywood. Use a screw just long enough to grip panel.



FASTEST CORNER BEVELING is done with a portable router, where space permits. With careful planning, hard-to-reach spots can be routed before assembly. Different cutters provide simple rounding or a decorative molded edge.

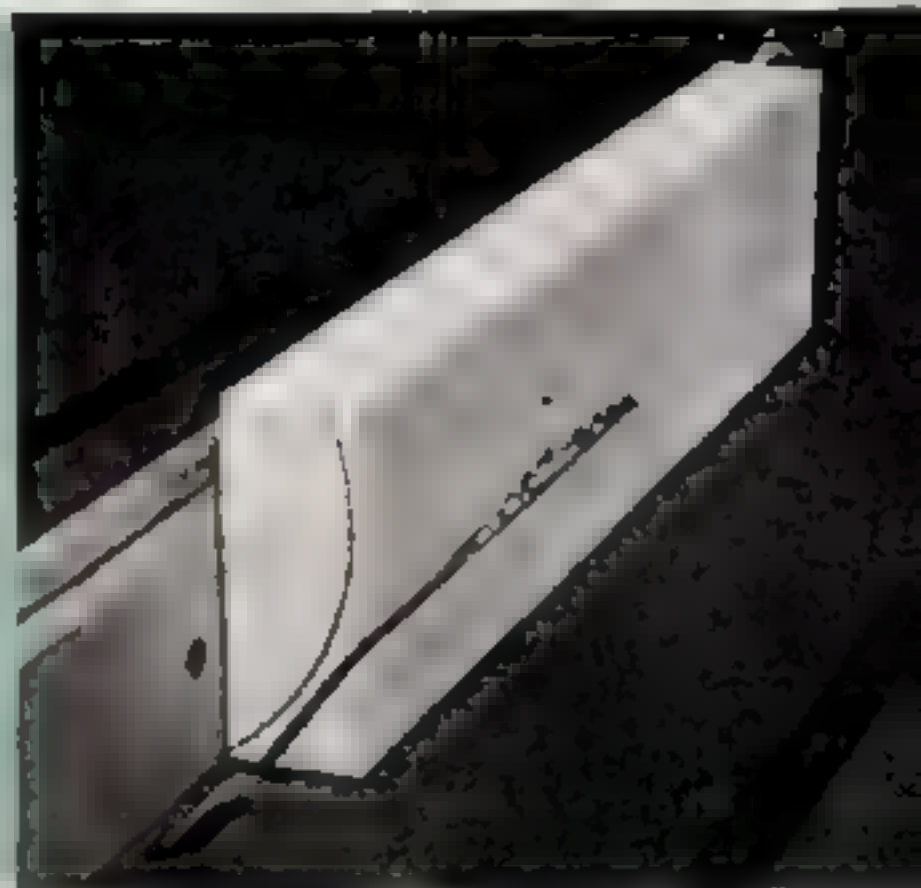
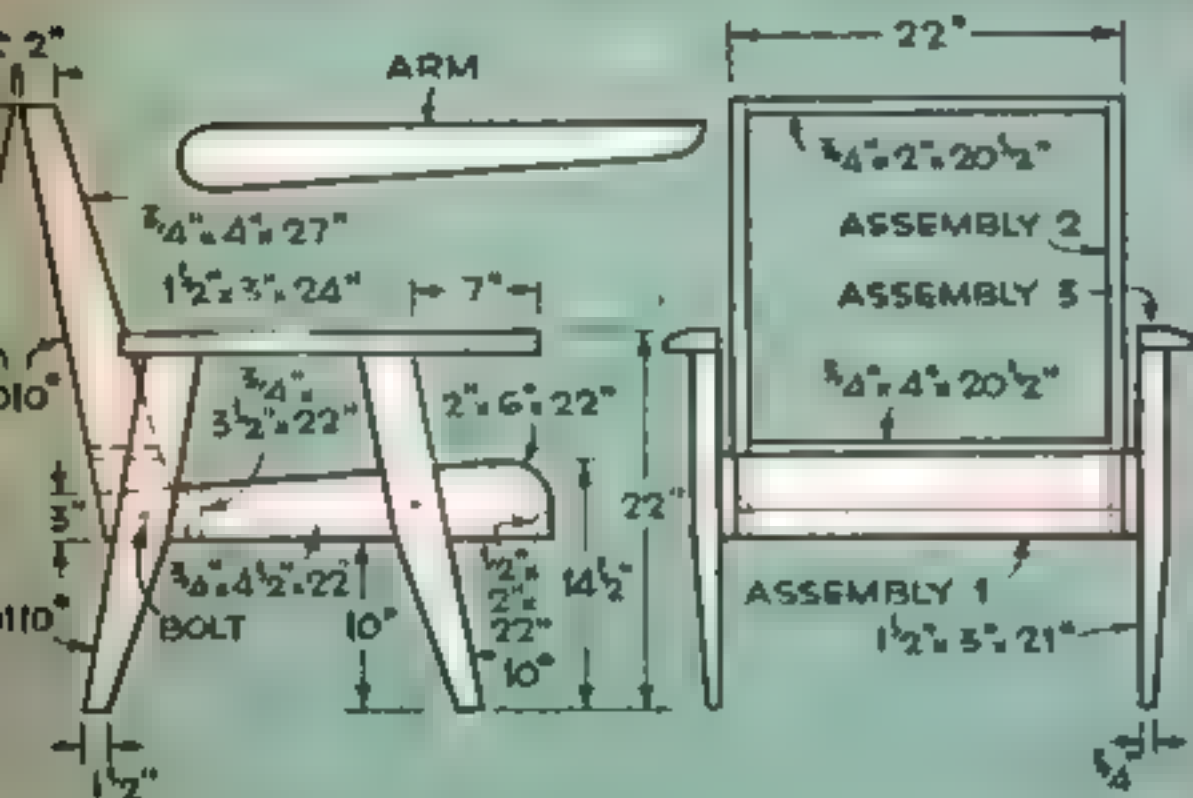


with strength: the more slant, the more chance of separation at the joint. In most chairs, the load is greatest over the back legs. When the sitter leans back, strain is imposed where the back joins the seat frame.

The closer to vertical you keep the legs, the stronger the assembly. A slant of 5 degrees won't hurt, but going over 10 degrees is asking for trouble. Sometimes you can create a visual effect of slant by making a taper cut on the inside edge of a straight leg.

The simplified construction details shown on these pages can turn the chore of chair-making into an efficient and enjoyable operation.

Framework for semi-upholstered chair



DON'T SIT DOWN YET—both back and seat are open, to provide minimum framing required for webbing and padding. Or, install No-Sag wire springs and cover them with cloth, for use with

loose cushions. Upholster seat and back before assembly. Partly shape the front seat rail on the table saw (right) before it's attached; then plane it to conform to the side-rail curve.



How to pad panels

FOR SOFTER SITTING, plywood seat boards can be upholstered as shown in sketch below. Round corners with cloth cover by folding it to leave only two visible pleats, as at left. ■■



HOW TO MAKE A Set of Two- Tone Bongos

By Jim Purves

NOTHING livens up a party quite so fast as a set of bongo drums. For pure fun, no other musical instrument can compare.

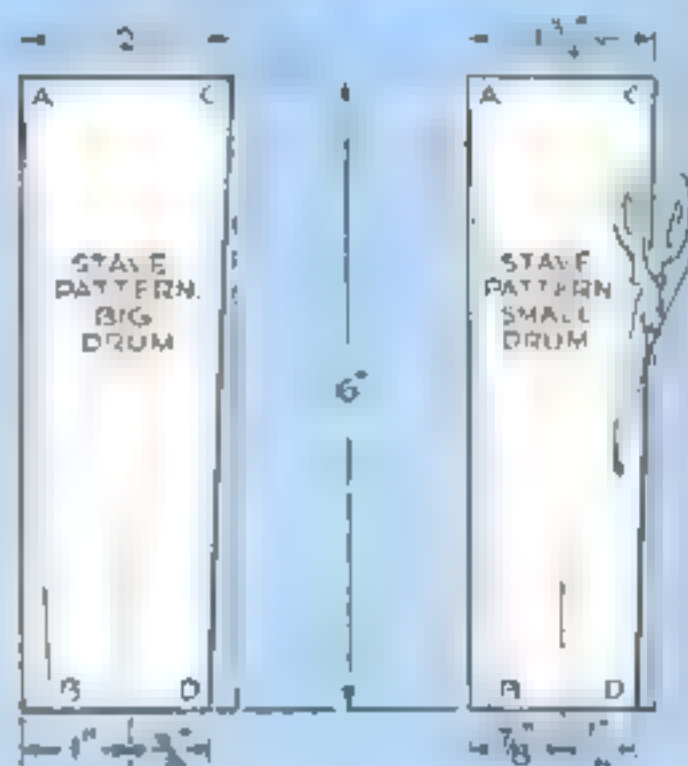
There's no tedious learning process. Your fingers itch to thump out a two-tone beat. In no time at all you can pick up the rhythm of any tune and play along like a pro.

The drum barrels are 12-sided hoppers made from tapered, beveled staves. I alternated walnut and pine for appearance, but almost any wood will do. Since the largest stave blanks are only 2" wide, you can easily rip stock into $\frac{1}{2}$ " thicknesses on your table saw.

If you don't own a lathe, round each barrel with a plane or Surform rasp, or run the corners over a jointer and finish up on a belt sander. Round off the top edge slightly so there won't be a sharp corner against the drum head. Finish the drum barrels and bracket with a couple of coats of good gloss varnish.

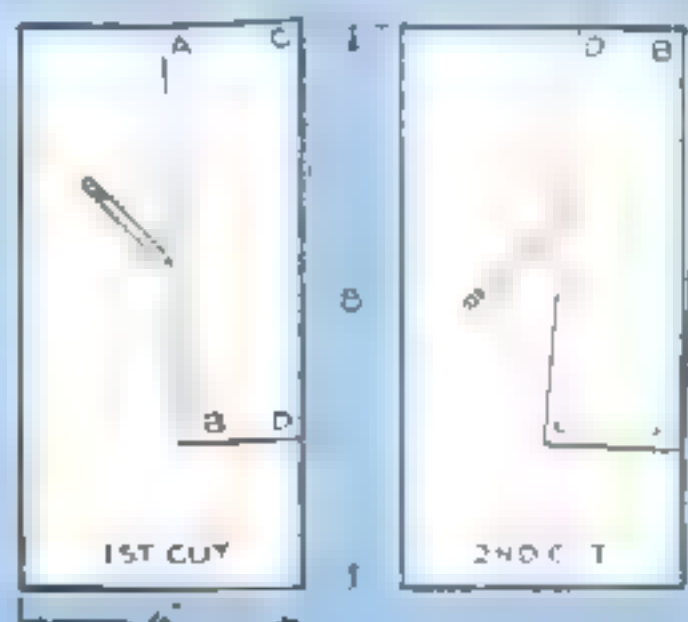
Attaching the skin. Most music stores sell bongo-drum heads these days for about \$2.50 a set. You can also buy whole goat-skin rawhides from leathercraft dealers. These cost from two to three dollars, and can be cut into several sets of drum heads.

Cut each head about 2" greater in diameter than the top of the drum it is to fit. The skin resembles parchment when dry, and cuts easily with scissors. Soak



1. YOU NEED STAVE PATTERNS to lay out the cutting jigs. Make full-size paper pattern for both sizes; trim off the C/D taper and align this cut with the right edge of the plywood.

2. TRACE AROUND THE PAPER and saw out the notch. Each drum requires two jigs, for the second one, invert pattern and align side AB with edge of another piece of plywood.



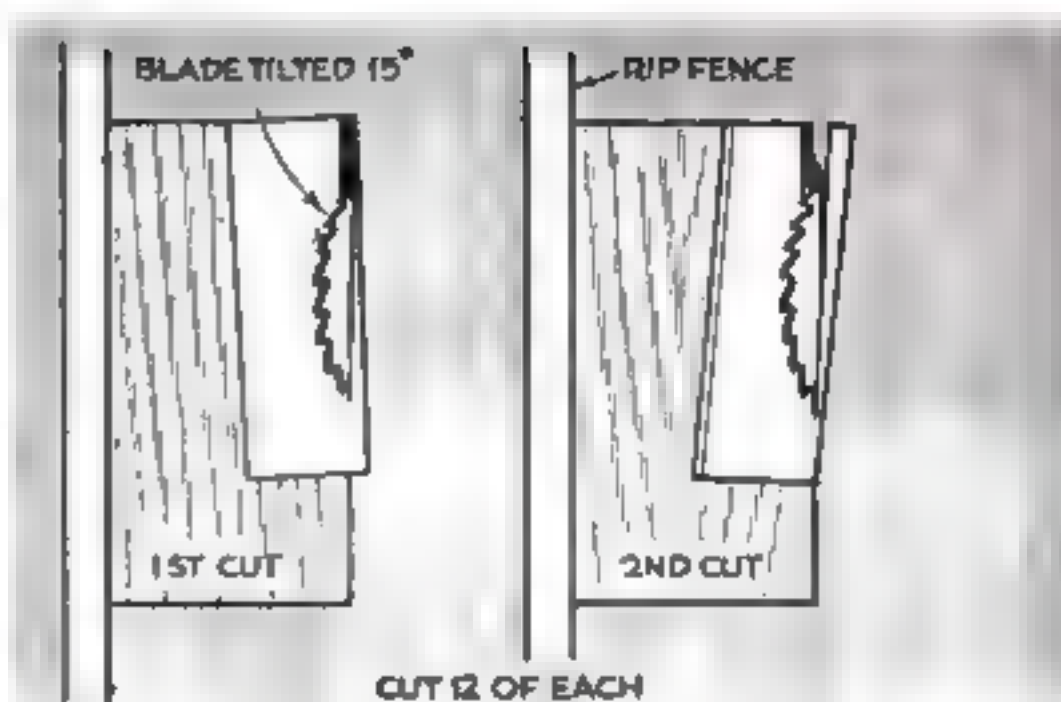
CONTINUED

the skins for 15 or 20 minutes in warm water—until they become soft and rubbery. Blot each with a towel before stretching it on the drum.

Begin application by stapling the skin at one side of the drum, then stretching it across to the other side and stapling there. Stretch it as tight as you can, using only your fingers. Work your way around the drum, keeping the skin taut.

Since the skin stretches considerably, don't be discouraged if, despite your best efforts, it sags. As it dries, it shrinks and tightens up.

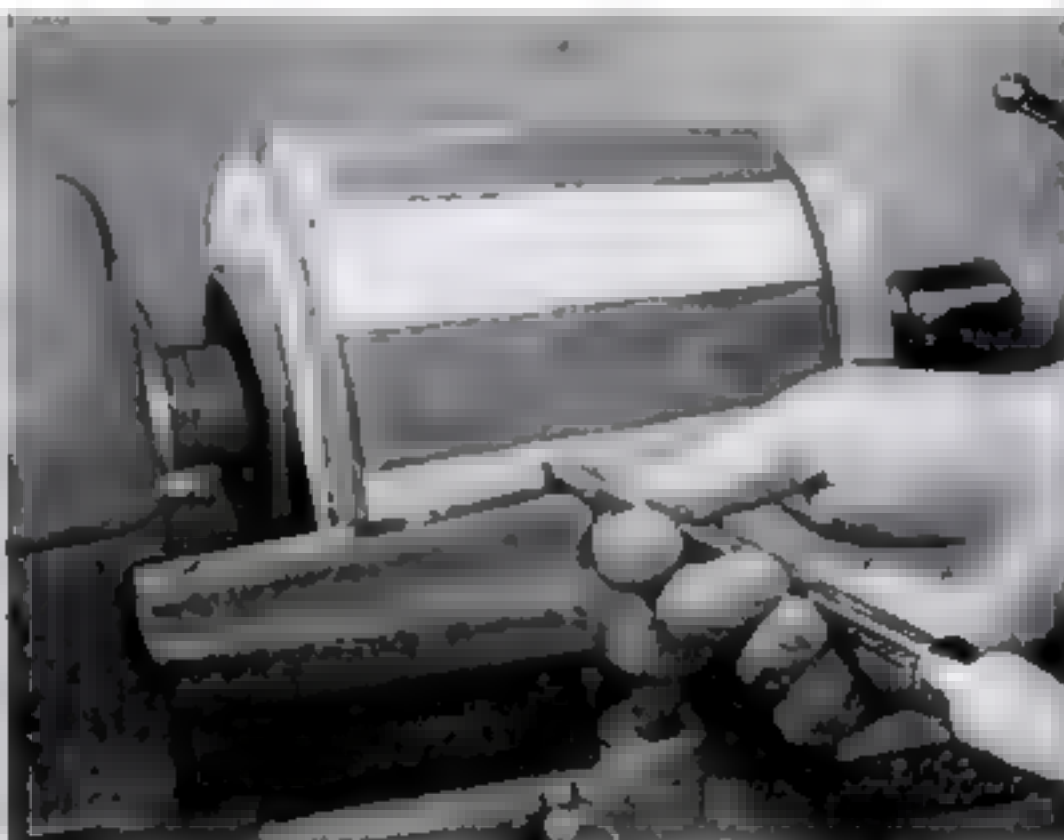
A little warmth (from a hot-air register, or even a light bulb) speeds the process and results in a tighter head than with natural drying. But don't overdo: Too-rapid drying can split the skin.



3. RUN STAVE BLANKS through table saw in first jig, then invert them and run through in second. If staves won't form tight cylinder, increase blade tilt, retrim them with second jig.



5. CURL INTO A CYLINDER, bringing outside edges of fan tightly together. Seal down tab ends of tape and let glue set overnight. No clamps are needed if the bevels are tight.

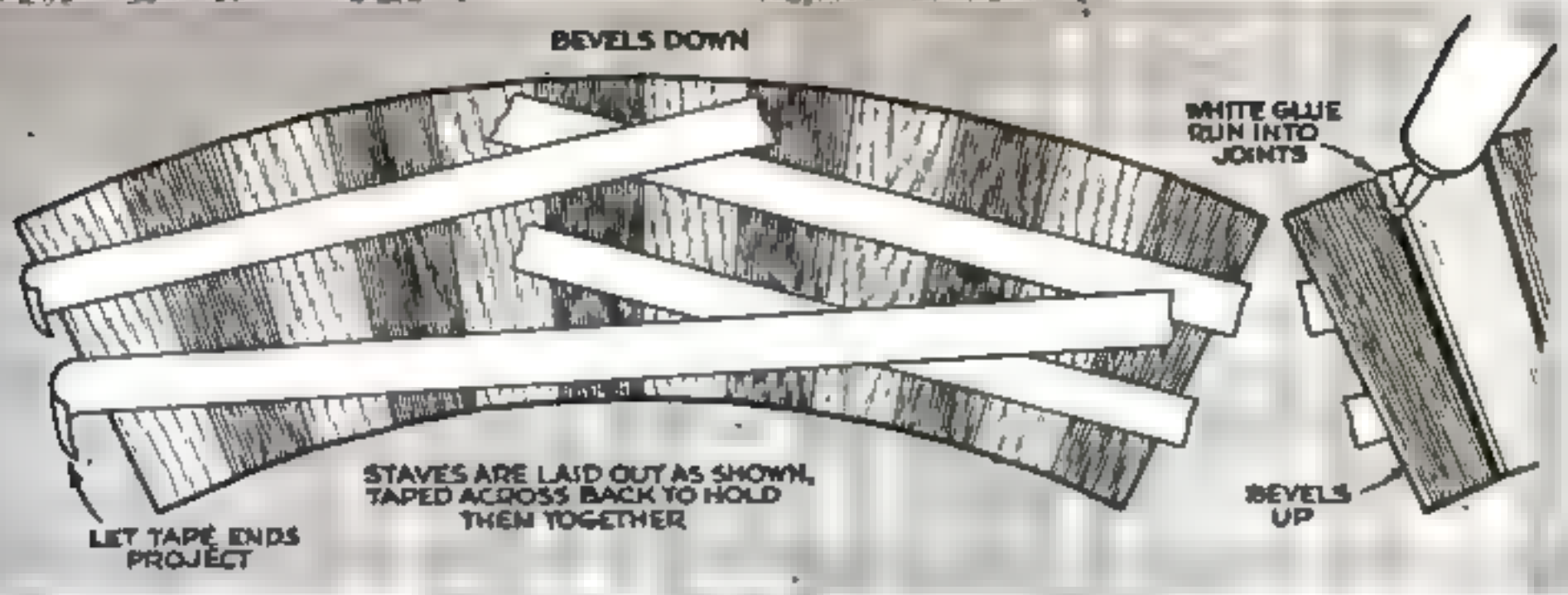


6. ROUND THE BARREL in a lathe; cut plywood disks and bevel the edges to a wedge fit inside each end. Mount larger disk on a faceplate, move cup center snug against other one.

Picture Framing the Easy Way

LAP together two strips of wood (1) and you get around the problem of cutting a rabbet for the picture. Miter the corners and assemble the frames (2) with glue and corner fasteners such as Chevrons (made by E. B. Packard Co., 139 Cedar St., NYC). Countersink the fasteners, conceal with wood filler, apply finish to the wood—and the frame's ready for the picture (3).

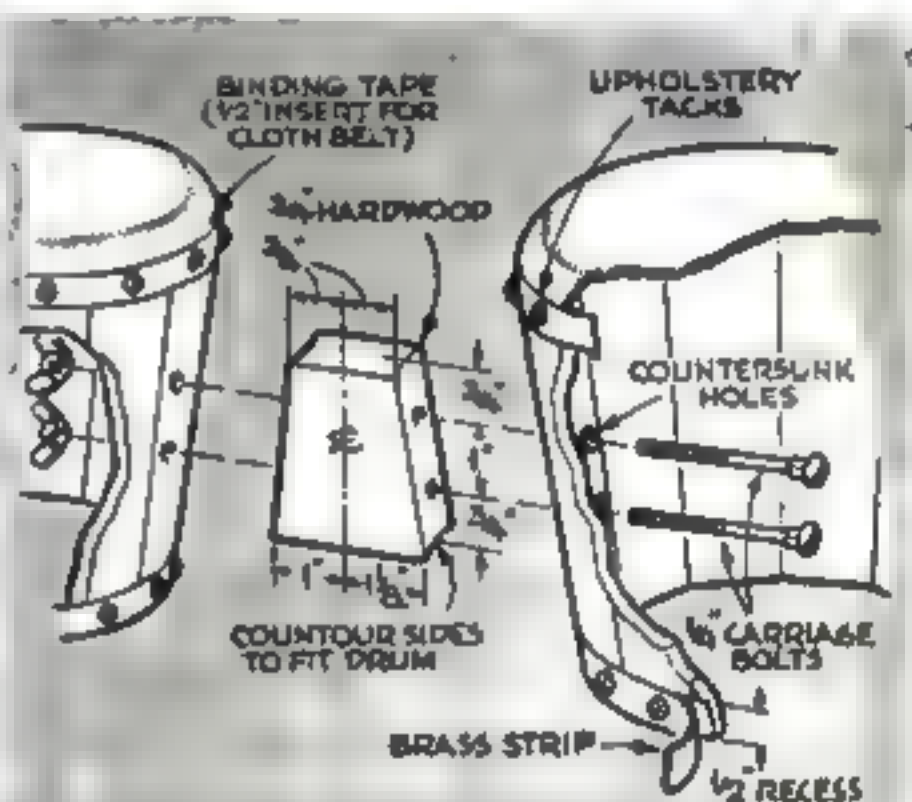




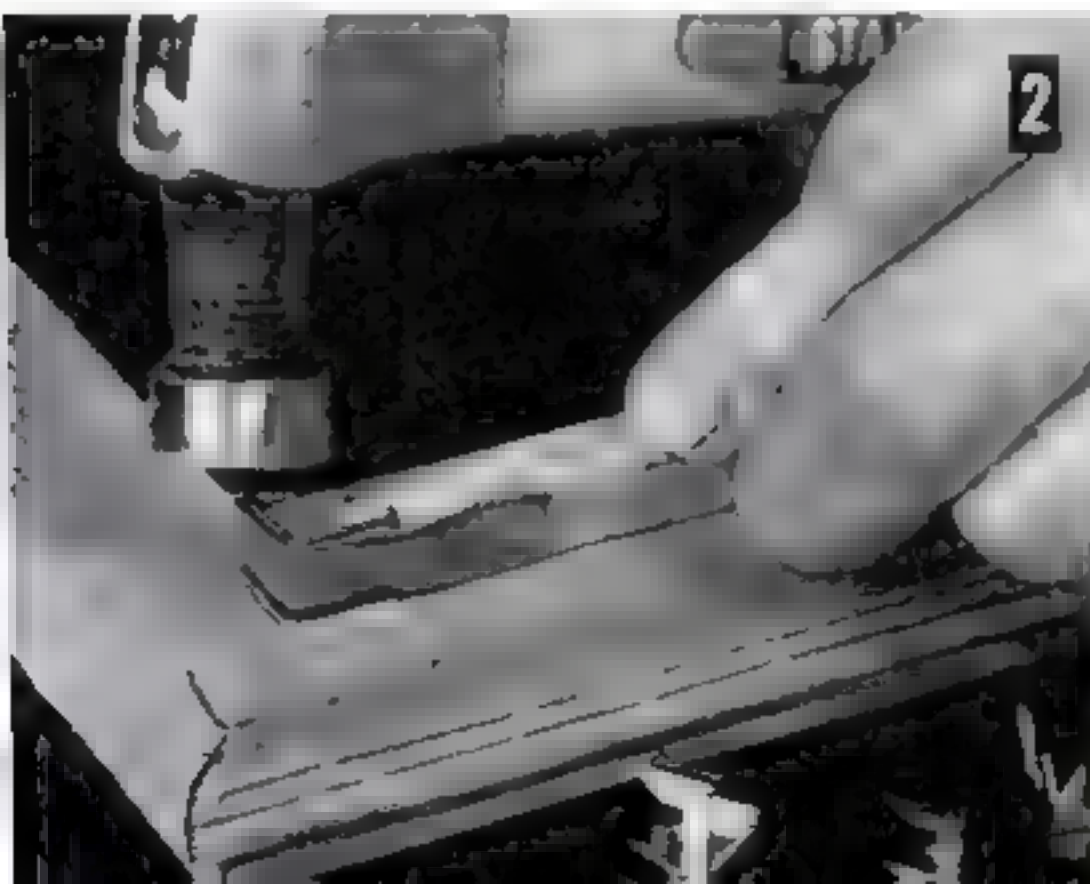
4. FORM A FLAT FAN by butting 12 identical staves edge to edge, beveled side down. Apply strips of masking tape, as shown at left, making sure they adhere to all staves. Now flip the fan over and lay a bead of white glue in each joint bevel and along the outside edges.

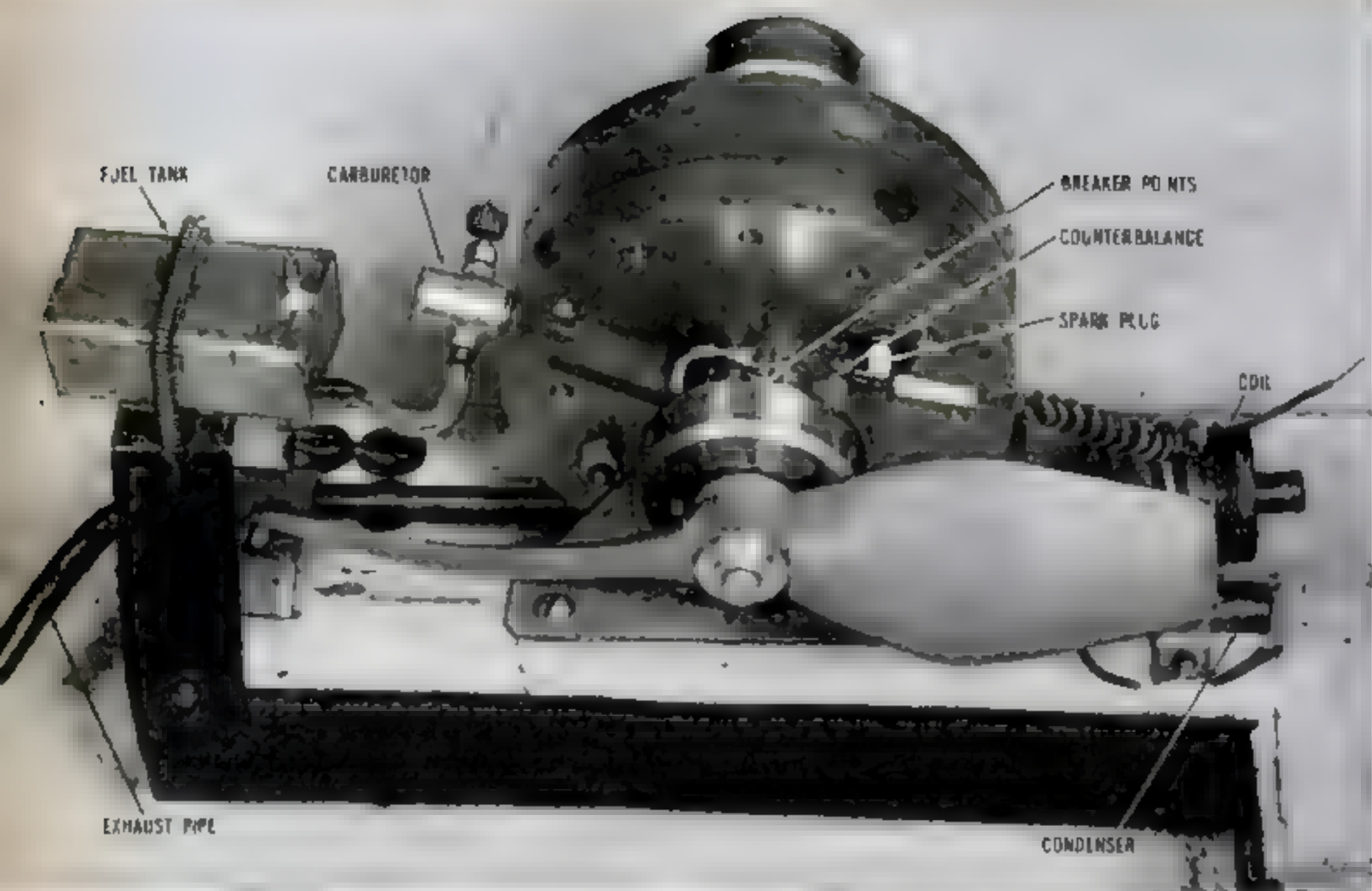


7. STAPLE ON THE DRUM HEAD: Keep staples in a neat line by taping a block to the bottom of the stapler, recessed from front end the distance you want staple line below the rim.



8. BOLT DRUMS TOGETHER through bracket, using wingnuts to permit disassembly if head needs replacing. Bore bracket first. Hold it against each drum as guide for drilling staves.





THREE-LOBE ENGINE is a copy of the Wankel, but smaller. It was built largely from details given

in a PS report on a successful rotary engine invented by the German engineer, Felix Wankel.

Father and Son Build Dream Engines

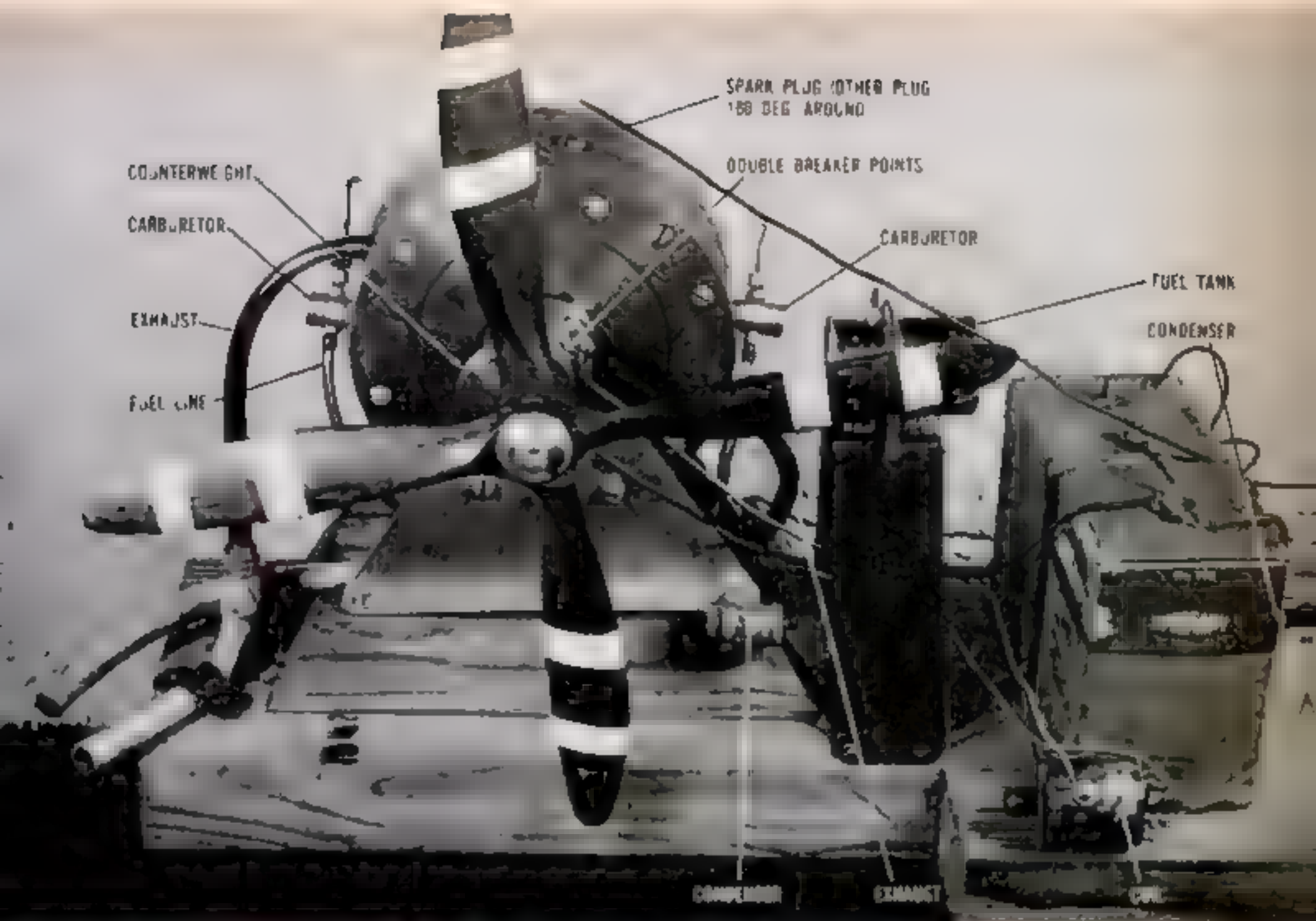
By Herbert R. Pfister

DREAM engines become reality in the skilled hands of two Florida machinists—William Thomas Sr., and William Thomas Jr.—a father-and-son team.

Shortly after reading the POPULAR SCIENCE report on the rotary engine invented by Felix Wankel in Germany (Mar. '60, p. 82), the Thomases went to work. Their engine has a three-lobe rotor like the Wankel, but is smaller—only $\frac{1}{2}$ -cubic-inch displacement. It puts out about $\frac{1}{8}$ hp. at 5,000 r.p.m.

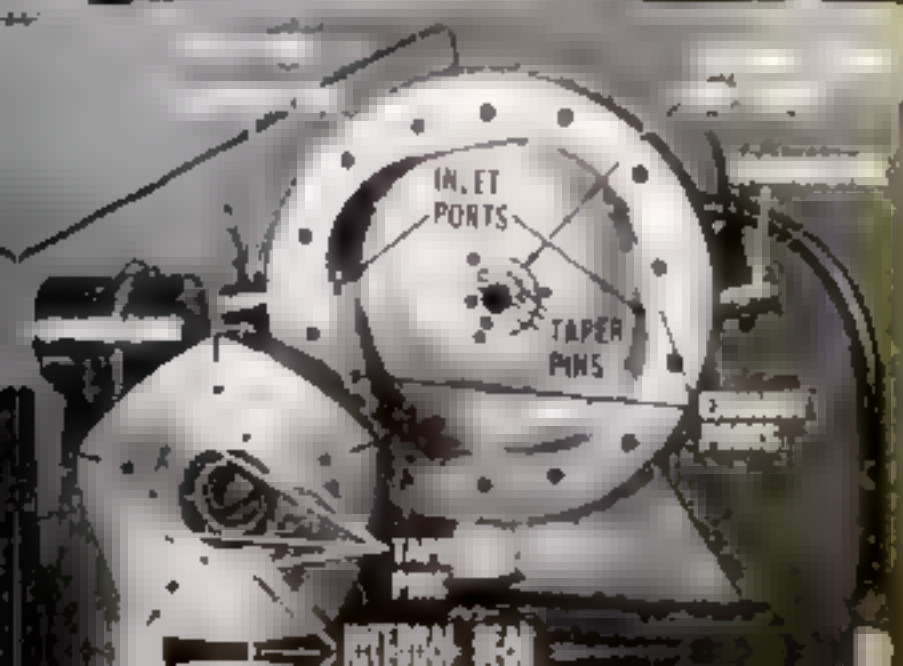
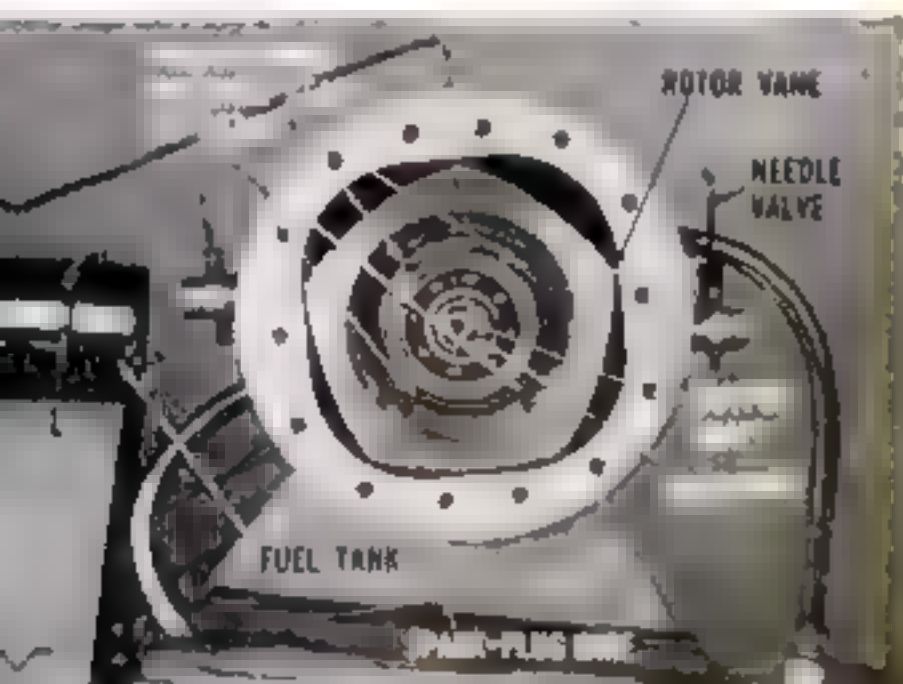
The success of this engine didn't satisfy the younger Thomas, though. He went on to design and build a second rotary, a new concept with the power overlap of two Wankel engines. A five-lobe rotor and $1\frac{1}{4}$ -cubic-inch displacement delivers $\frac{1}{8}$ hp. at 4,500 r.p.m.

The five-lobe rotor is to the three-lobe model what a two-cylinder engine is to a one-lunger. Two spark plugs, two carburetors, and two exhaust tubes are spaced 180 degrees apart from each other to pro-



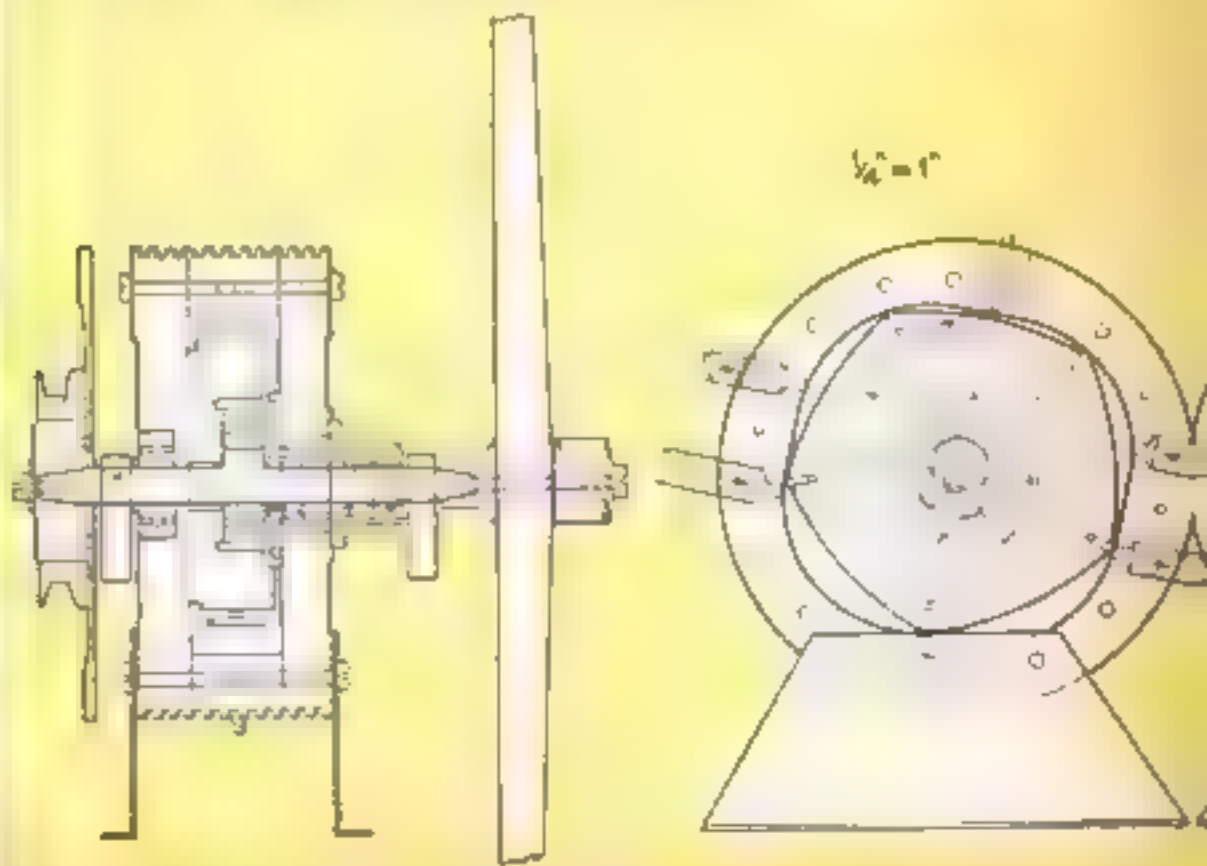
BRAND-NEW CONCEPT is this five-lobe rotary engine designed and built by William Thomas Jr.

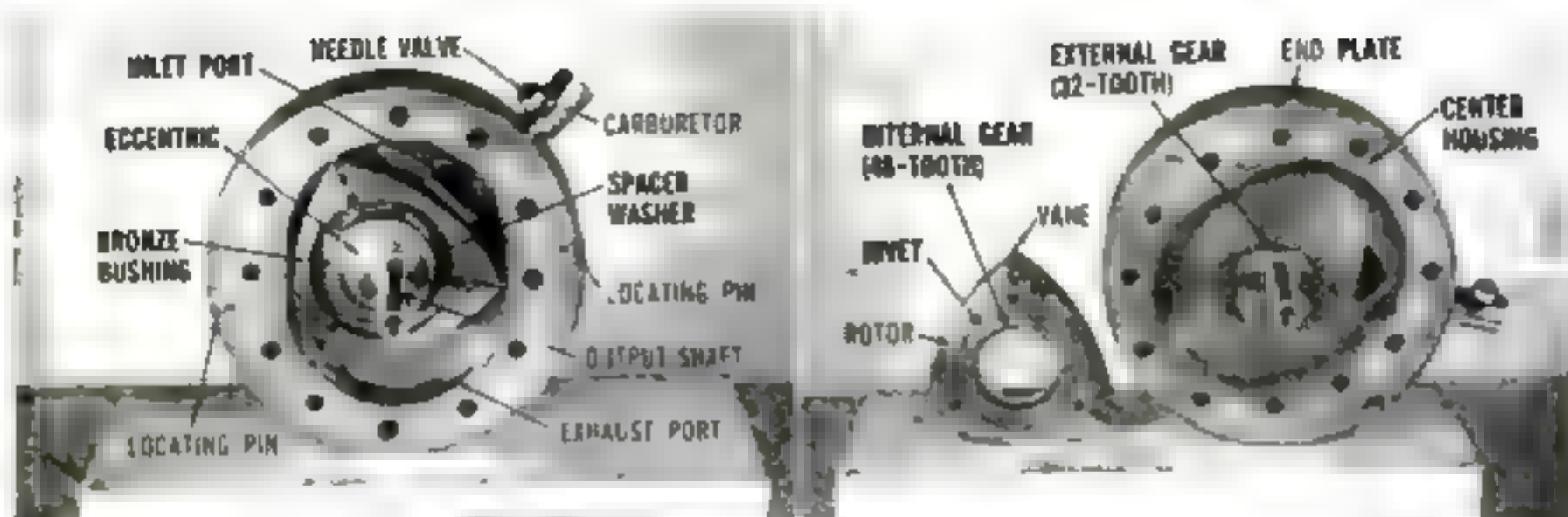
It is equivalent to two Wankel engines operating together, 180 degrees out of phase.



Details of the five-lobe engine

DOUBLE IGNITION, fuel and exhaust systems function independently to provide five power impulses for each revolution of the rotor. The ignition even has two sets of breaker points. Though nearly twice as effective as the Wankel engine, Thomas' improved version retains the basic simplicity; it still has only two main moving parts—the rotor and the output shaft.

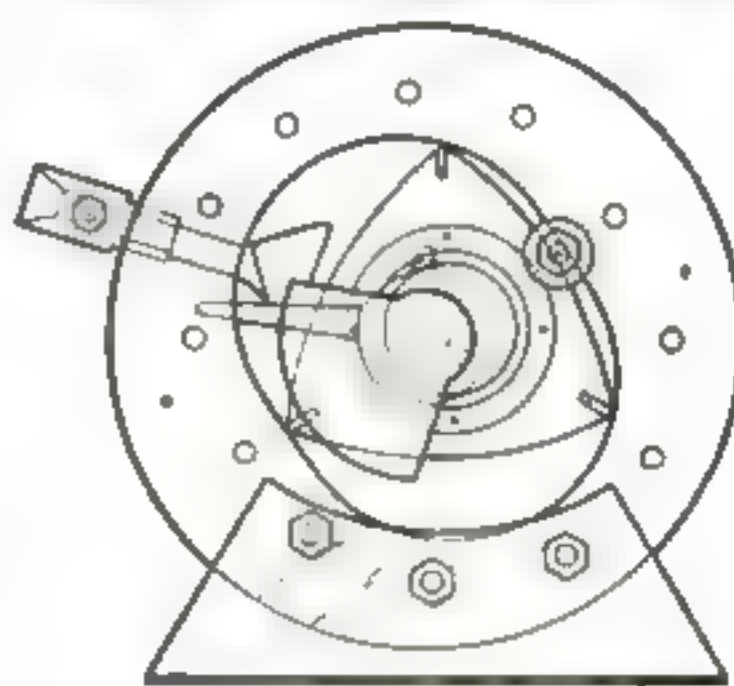
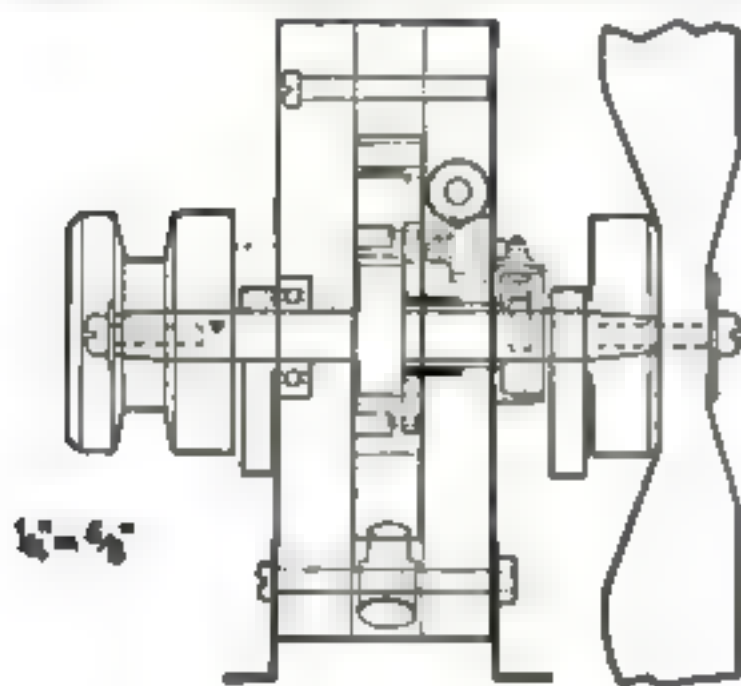




Details of three-lobe engine the Thomases built

COMBUSTION CHAMBER and three-lobe rotor can be seen above at left. Springs press vanes against wall of chamber. Carburetor is model-plane type. Drive gears

on rotor and output shaft convert eccentric action of rotor into true rotary motion at shaft. Inlet and exhaust ports need no valves; the rotor opens and closes them.



vide five power impulses per single revolution of the five-lobe rotor. The cycling is similar to two Wankel engines in tandem, but 180 degrees out of phase. Operation is smooth and balance is excellent.

The fuel and ignition systems. On both engines, Thomas used model-airplane parts—McCoy carburetors, Forster 29 breaker points, Aero spark coils, and Champion V3 spark plugs. Automobile condensers were installed across the points. Power for the ignition is supplied by two doorbell batteries connected in series for 3 volts. Both engines run on a mixture of $2\frac{1}{2}$ parts gasoline to 1 part No. 40 oil. The addition of 10 percent of acetone makes cold starting easier.

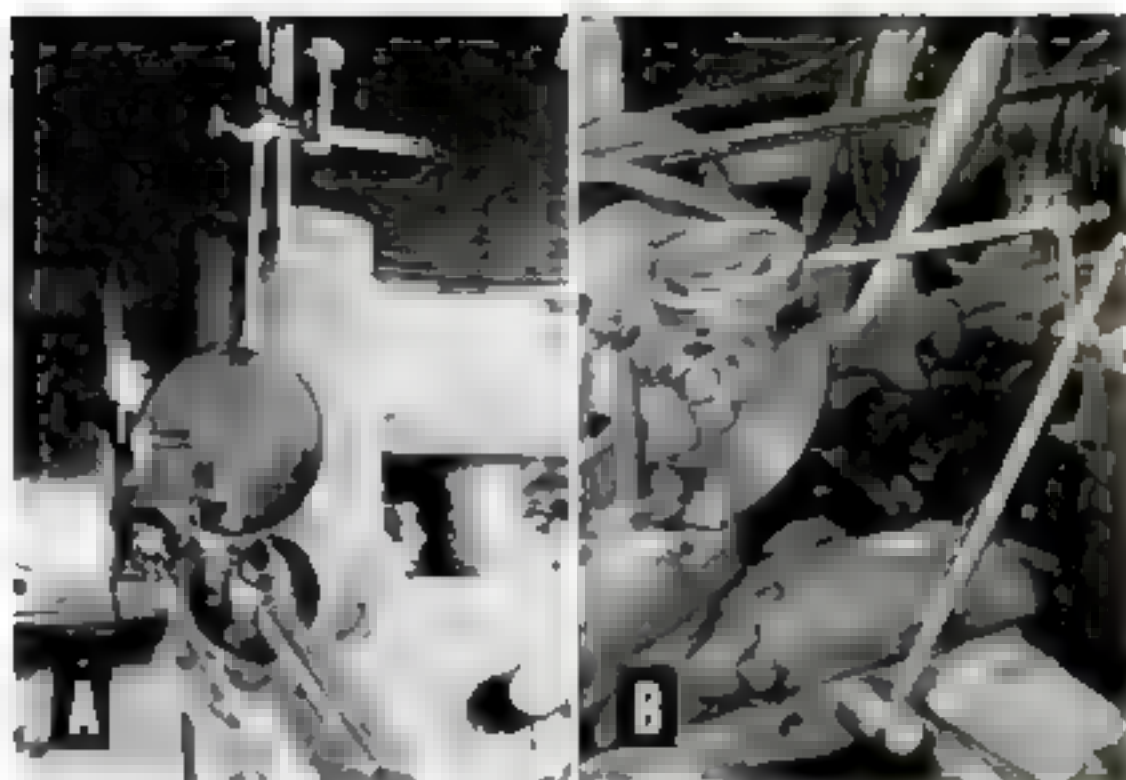
Shaping the irregular chamber was the most difficult step in the construction of both engines. The contour was laid out by fastening a scribe to one apex of the rotor and "hula-hooping" the ring gear

around the pinion mounted in the center of the housing. The housing was set up in a four-jaw chuck and each of the arcs bored to the scribed line. The necks of the trochoid were carefully machined to the line with a rotary file. This was followed by an abrasive drum chucked in the drill press.

Getting set. A preliminary assembly was made and the chamber was coated with lapping compound (alumina and oil) to lap the vanes and chamber by motoring the engine. After a thorough cleaning, the side clearances were fitted. A steel vane is fitted into a slot cut in each apex of the rotor. A spring behind each vane presses it firmly against the chamber to make a tight seal between the lobes.

Thomas uses the engines to turn propellers. A small pump can also be driven efficiently if care is taken with sealing and compression. ■ ■

One MACHINIST tells another...

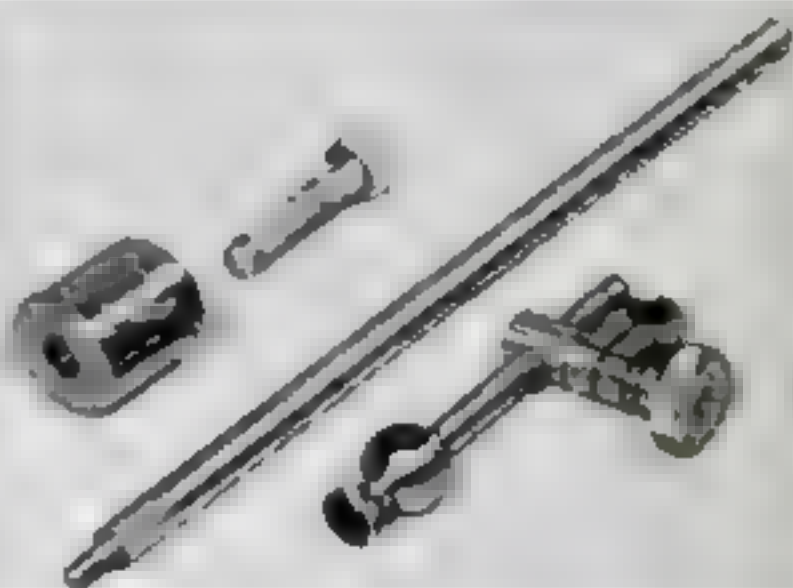


...A Magnifier Is a Handy Attachment for the Lathe

IS THERE anyone with a screw-cutting lathe who, at one time or another, hasn't needed a magnifying glass attached to the carriage? There's an easy way to install one, using the parts of a Starrett No. 196 universal dial indicator. Or you can turn similar parts.

The upright post is patterned after a shorter one included with the set. It is an 8" length of $\frac{1}{4}$ " drill rod with a #10-32 thread on one end and a decorative ball turned on the other. Immediately below the ball is a $\frac{1}{8}$ " hole at right angles to receive a small rod or nail, for tightening or loosening the rod.

To attach the magnifier to the cross slide as in photo A, lightly centerpunch a centered point $\frac{1}{8}$ " from the end of the cross-feed apron. Drill a #21 hole and thread #10-32. You can also mount the



attachment as in photo B. This uses a $\frac{1}{4}$ "-18 threaded hole provided for attaching a follower rest. Parts are the same except for the addition of a steel sleeve 1" long of $\frac{1}{8}$ " o.d. and $\frac{1}{4}$ " i.d.—J. P. Goodenough, Milwaukee.

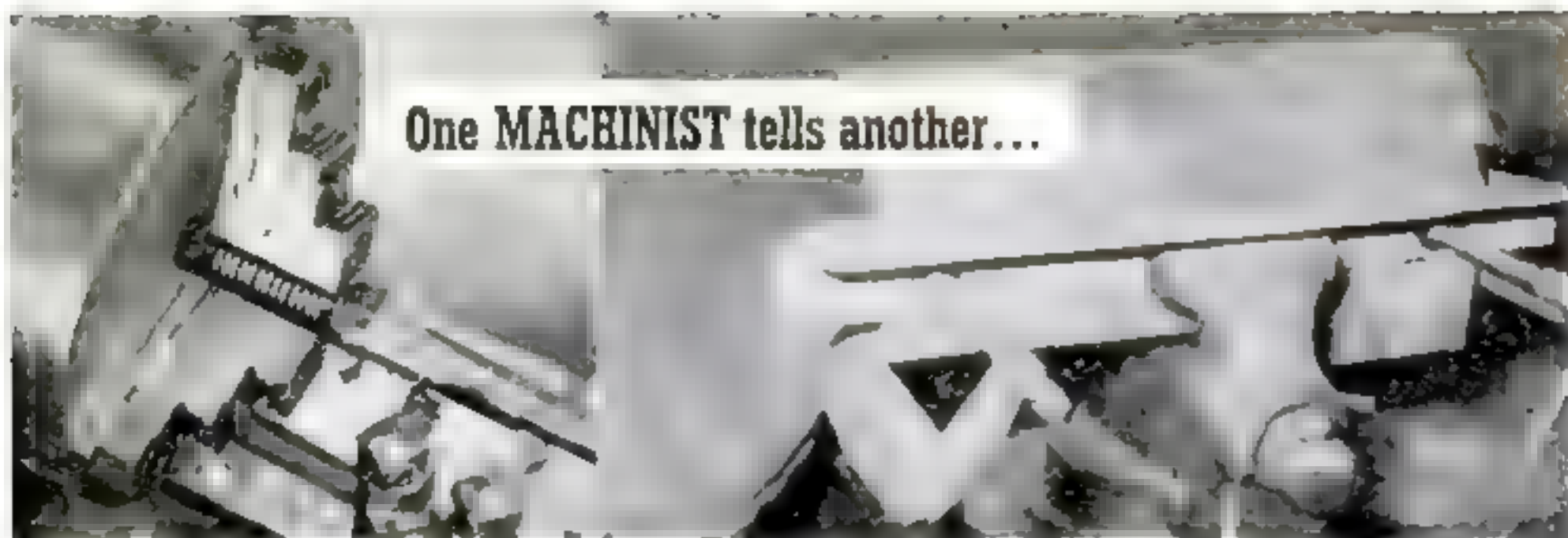
How to Store Extra Taps

A MODEST assortment of taps or extras for which you have no place in your regular set can be safely stored in a flat tin box of the kind that holds small cigars, bandages, and other products.

Cut corrugated cardboard to a snug fit and lay it inside the box to form partitions for the taps. Identifying numbers can be lettered on paper glued inside the lid. A set of spare taps can be kept in the corrugations under the cardboard.—Harry Walton, White Plains, N. Y.



One MACHINIST tells another...



Protect Screw Threads

USE soft brass or copper wire to protect threads that must be gripped in a lathe chuck. Wind the wire into the groove. Wire must be just large enough in diameter to project slightly above the thread.—*H. J. Gerber, Stillwater, Okla.*

How to Improvise a Bending Brake

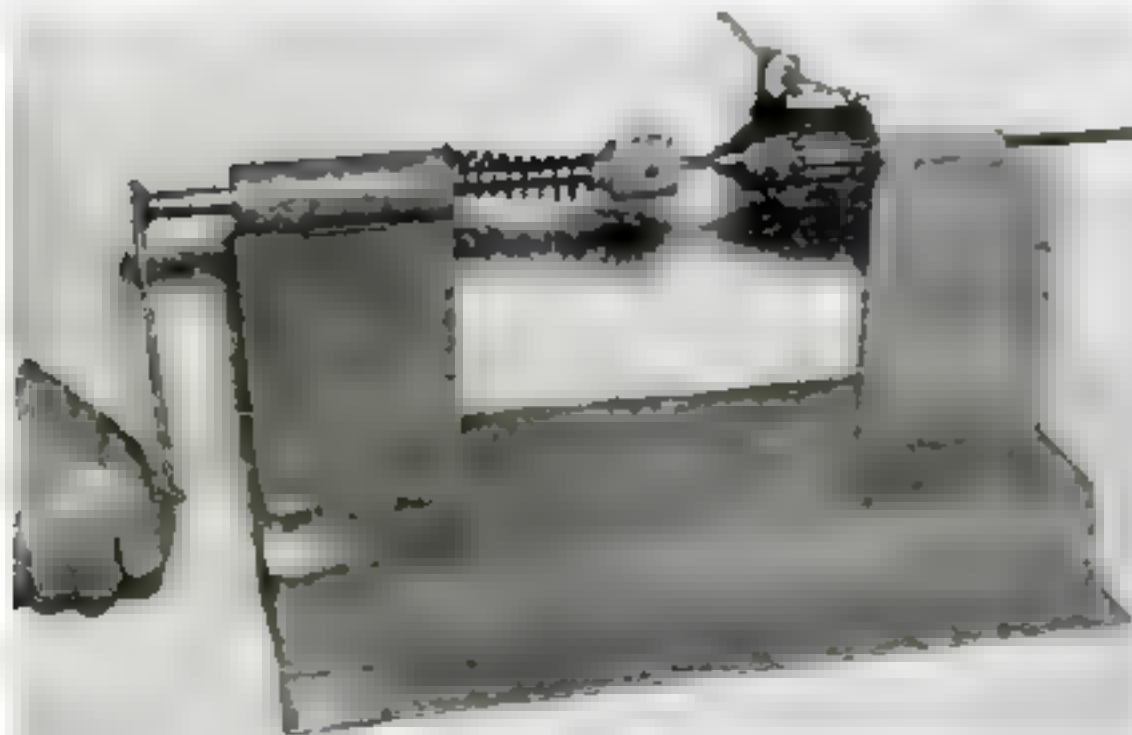
IT WAS a weekend and no sheet-metal shops were open when I needed several pieces of tin bent to 90 degrees. So I placed two pieces of angle iron in a vise with the tin between. I then tightened the vise and C clamps placed at the ends of the angle iron. I have successfully bent pieces up to 6' long this way.—*John A. Fogle, North Sacramento, Calif.*

How to Lock a Setscrew

WHEN you want to lock a headless setscrew by putting another in after it, be sure to grind the point off the second one (see drawing). Otherwise, it will burr the socket hole in the first screw so you can't remove it with the wrench.—*K. E. Hague, Canton, Ohio.*

Chuck Mark Saves You Time

WHEN I bought a lathe with a three-jaw chuck that had a single wrench socket, I painted a stripe on the face and edge of the chuck to mark the socket location. This saves a lot of time rolling the chuck over by hand looking for the socket.—*A. Walker, Hemet, Calif.*



How to Make a Threading Machine

IN OUR small shop we don't have enough threading to do to justify power equipment. So we made a hand-operated threader. It does the job handily and insures straight threads on rods up to $\frac{3}{8}$ " diameter. The chuck takes rods of any length and holds them aligned with the die. The crank shaft is hollow so that several inches of thread may be put on a rod.—*Earl Allgaier, Arlington, Va.*



Jig Guides Saw for Slitting or Cutting Screw Slots

THIS simple jig affords fair accuracy in slitting rods or tubing on a diameter or cutting slots in screws.

Hacksaw a shallow vertical cut across a small block of metal. Make a center-punch mark in the cut and drill a hole through to hold the work. For screws, the hole may be tapped and the work

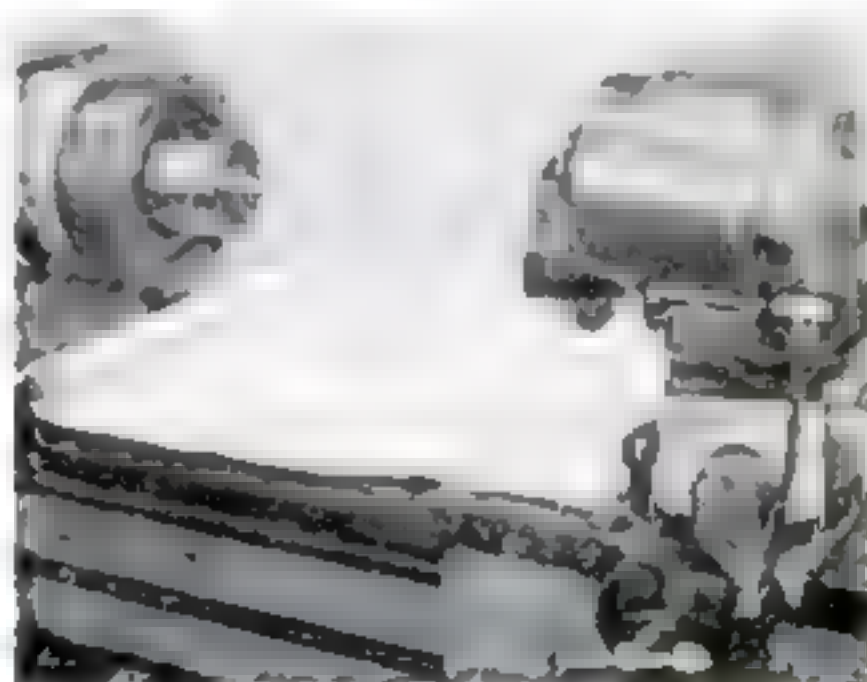
held with a lock nut underneath. With a cross slot made as in the drawing, round stock is locked by clamping in a vise. For headed screws or two-diameter work, countersink or counterbore the hole.

Long slits are made by cutting to the cut depth in the jig and moving the work up.—*Harry Walton, White Plains, N. Y.*

Shade Protects Lathe Ways

WHEN I use a tool-post grinder, a roller shade keeps grinding dust from entering between the bed ways and the carriage. The shade automatically rolls up and unrolls as the carriage moves along the bed.

The width of the shade was reduced somewhat and the roller shortened at the solid end. With the roller wired and clamped to the headstock, the roller latch was disengaged and the free end of the shade fastened to the carriage.—*H. J. Gerber, Stillwater, Okla.*



Tips for Grinding Drills

GRIND the cutting edge or lip of a twist drill with a slight flat (sketch A) to minimize hogging in when drilling soft copper or brass. The same treatment will keep drills from corkscrewing through when you drill light sheet metal.

Corkscrewing can be dangerous and cause drill breakage.

To insure that a hole is a close fit for the drill size, grind a slight flat around both outside edges of the cutting lands as in sketch B. This creates a wedge action and eliminates the tendency of the drill to cut slightly oversize. A pilot hole should be drilled first.—*Ervin Wragg, South Amherst, Ohio.*





That darkroom light (if it's a screw-in bulb) will be handier in a spring-clamp socket. Clamp it anywhere—or perch it on an adjustable stand (left) so you can keep it at whatever distance from the work you choose.

Lighting Tips for a Photographer



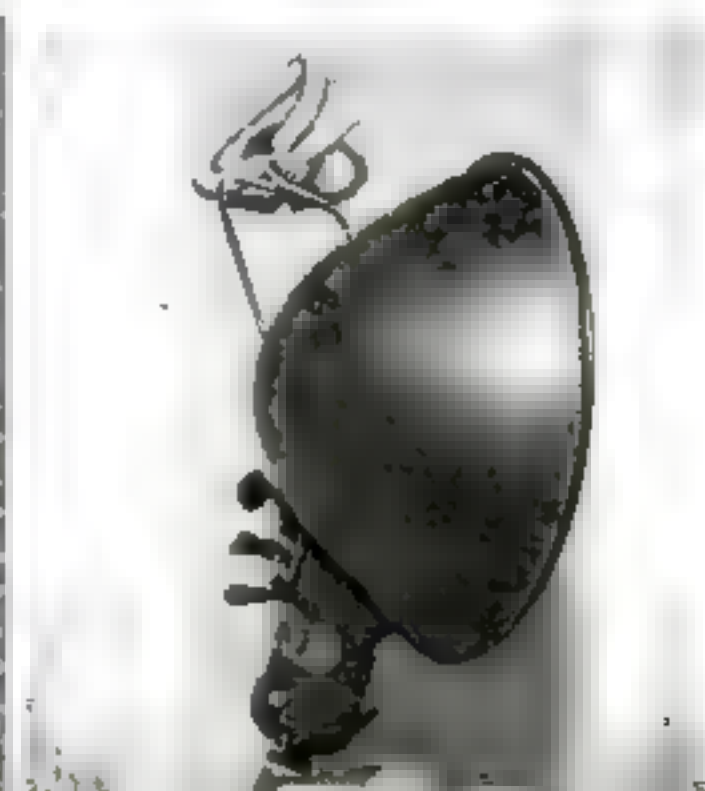
Need a low-angle light? There's no sturdier stand for a spring-clamp reflector than a household iron. Try it for background fill-in when lighting portraits.

Use a tripod handle to support a photo-flood and you won't need a separate light stand. Just turn the handle so it's to one side of the camera. The light follows the camera as you change positions.



Use extra reflector as a clamp stand for a bounce-light panel. It also allows you to position a cardboard background easily for table-top photos or movie titles.

Hanging an extension flash indoors often presents a problem. But there may be anchors you've overlooked. If you'll take down a picture frame or two, you'll find handy hooks for clamping the light.





Pivot-Sanding a Wooden Disk

WHEN a circular work piece does not have a center hole, you can still pivot-sand it with a dowel jig. Fasten dowels close to the board edge about 4" apart. Depth of cut is fixed by the position of the board with respect to the sander.—*R. J. De Cristoforo, Los Altos Hills, Calif.*

▶▶▶IF THE tape pressure pads of a tape recorder become worn and none is available through a dealer, buy a felt ukelele pick. Slice it in half and cut pads to size with sewing shears. Set with rubber cement.—*George V. Hook, Tracy, Cal.*



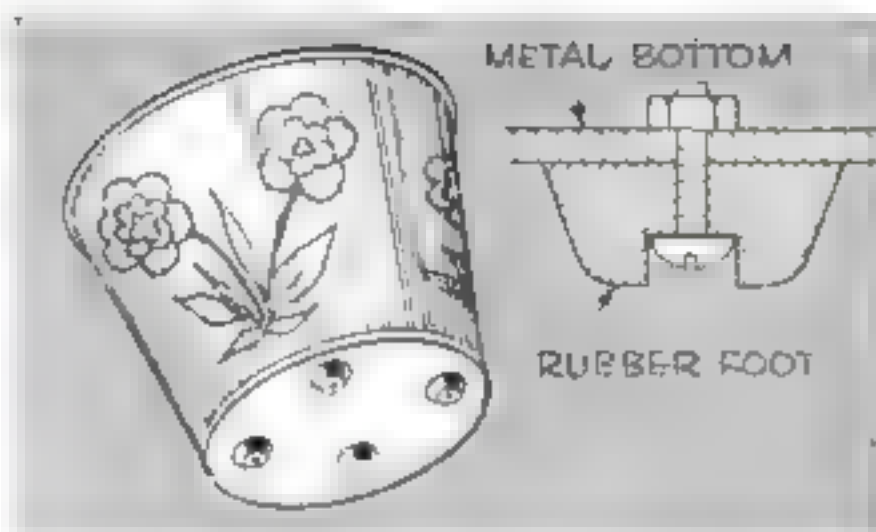
Towel Bar on Refrigerator Side

IN KITCHENS filled with built-ins there is often a shortage of space for a towel rack. But if one side of the refrigerator is exposed, it's as good as wall space.

Fasten the towel bar brackets with toggle bolts through drilled holes. Use rubber or cardboard spacers under the brackets.—*Charles H. Hoyt, Camas, Wash.*

Short Cuts and Tips

FROM PS READERS



Rubber Feet for Wastebaskets

RUST marks caused by metal wastebaskets often mar the bathroom floor. This can be eliminated by fastening four rubber feet to the bottom of the basket with machine screws. Raising the basket from the floor keeps the bottom dry.—*James A. Long, Greenville, Tenn.*

▶▶▶SMALL emery boards such as women use to shape their nails can be used for cleaning wire prior to soldering or splicing. The size is just right for close work, and the fine and rough grain can be used.—*M. J. Pelsang, West New York, N.J.*



Miter Jig for Portable Saw

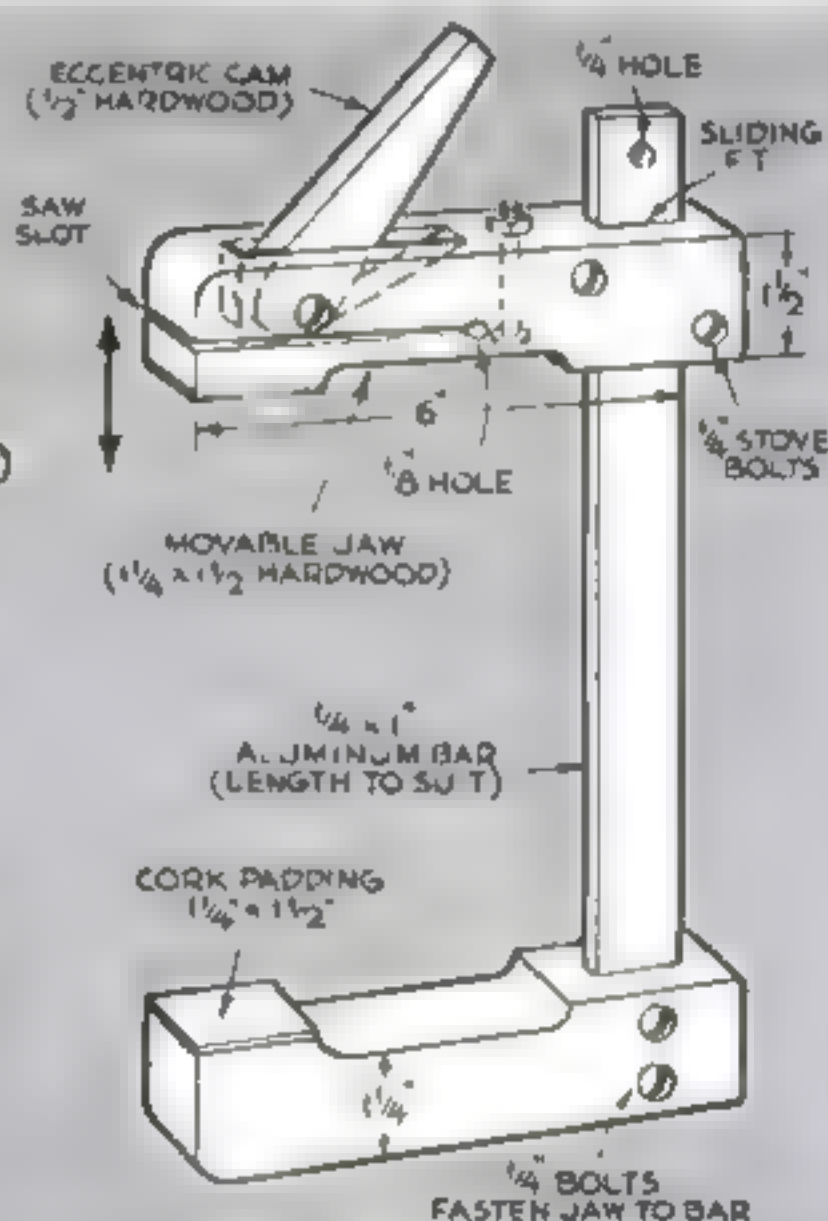
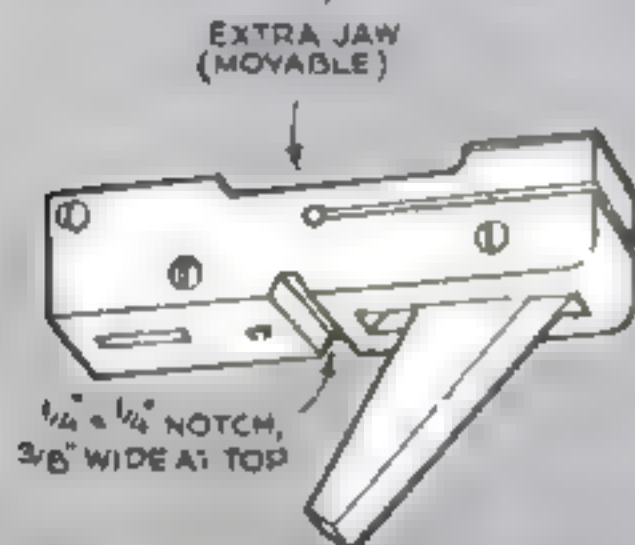
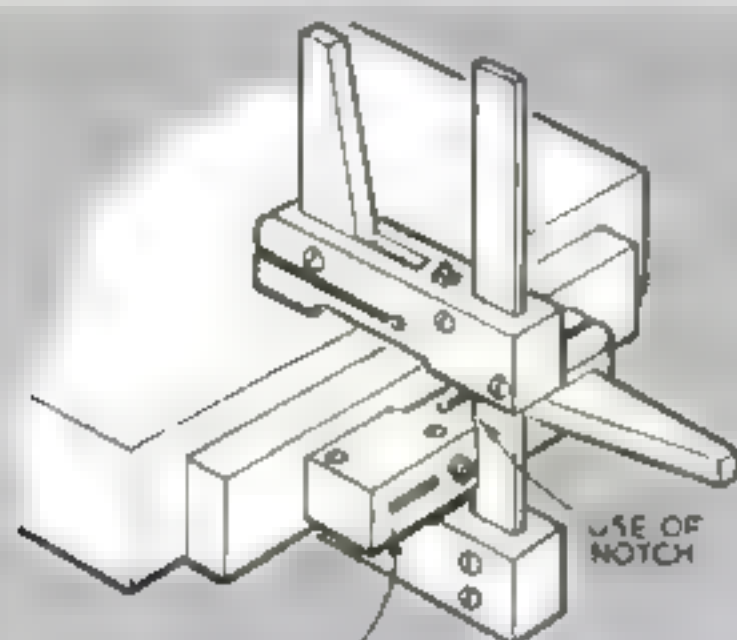
THE CHANNEL for this portable-saw miter box is made from a 30" piece of two-by-four, with two 12" one-by-twos nailed to the side to stick up an inch. The saw guide is a one-by-two nailed to a 16" one-by-six. Set the saw for 45-degree angle, rest the saw on the guide and cut.—*N. E. Knabusch, Stone Park, Ill.*

Short Cuts and Tips

FROM PS READERS

Two-Handed Picket Painting

THERE'S surely no finishing job as monotonous as painting a picket fence. I added a little variety—and a lot of speed—by funneling my paint into a large plastic squeeze bottle that had held a liquid kitchen detergent. In the top, I drilled a $\frac{3}{16}$ " hole. With this in my left hand, I squirted paint on one picket at a time, spreading it out with the brush in my right hand. The job went so fast, I painted my garage in the time saved.—*K. M. Aderson, Temple, Tex.*



Clamps from Scrap Wood Made in Any Length

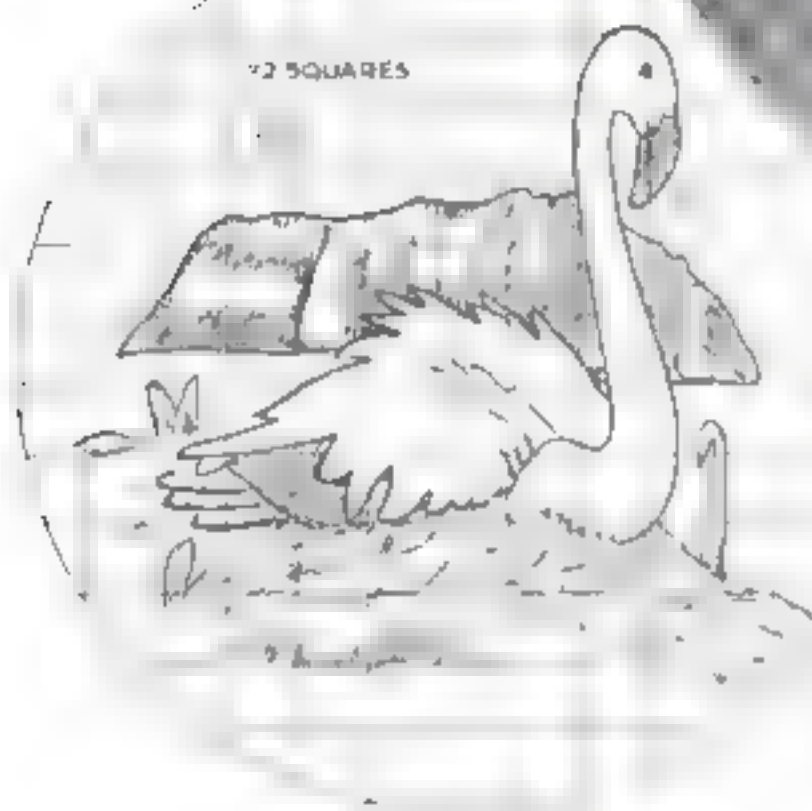
THOUGH they won't bear down as tightly as a screw clamp, these cam-locking bar clamps will apply the moderate pressure needed for most home gluing jobs.

They're easy to make from scraps of maple or other hardwood and do-it-yourself aluminum bar. Jaw capacity is limited only by the length of bar you use.

Rectangular holes in the jaws can be

drilled out and filed to a tight sliding fit on the bar. Bolts set in holes above and below the bar, and behind the saw cut in the movable jaw, reinforce the wood against splitting. Extra jaws, notched as shown, can be used to apply pressure from a different direction after the clamp has been locked on the work.—*James L. Crane, Sebring, Fla.*

Dental burrs in a flexible shaft—plus a set of forming blocks—make fast work of fancy trays



Shaping and Engraving Flat Aluminum

By Dick Hutchinson

TURNING out beautifully engraved objects of hammered aluminum sheet can be both fast and fun if you mechanize the operation. Chuck a tiny dental burr in a flexible shaft or hand grinder and you have a motorized pen that will trace intricate designs on trays and bowls just as if you were drawing on paper.

Shaping the aluminum can also be speeded up with the special jig shown on the following pages. It clamps the blank like a sandwich and lets you shape it accurately over a forming block. You

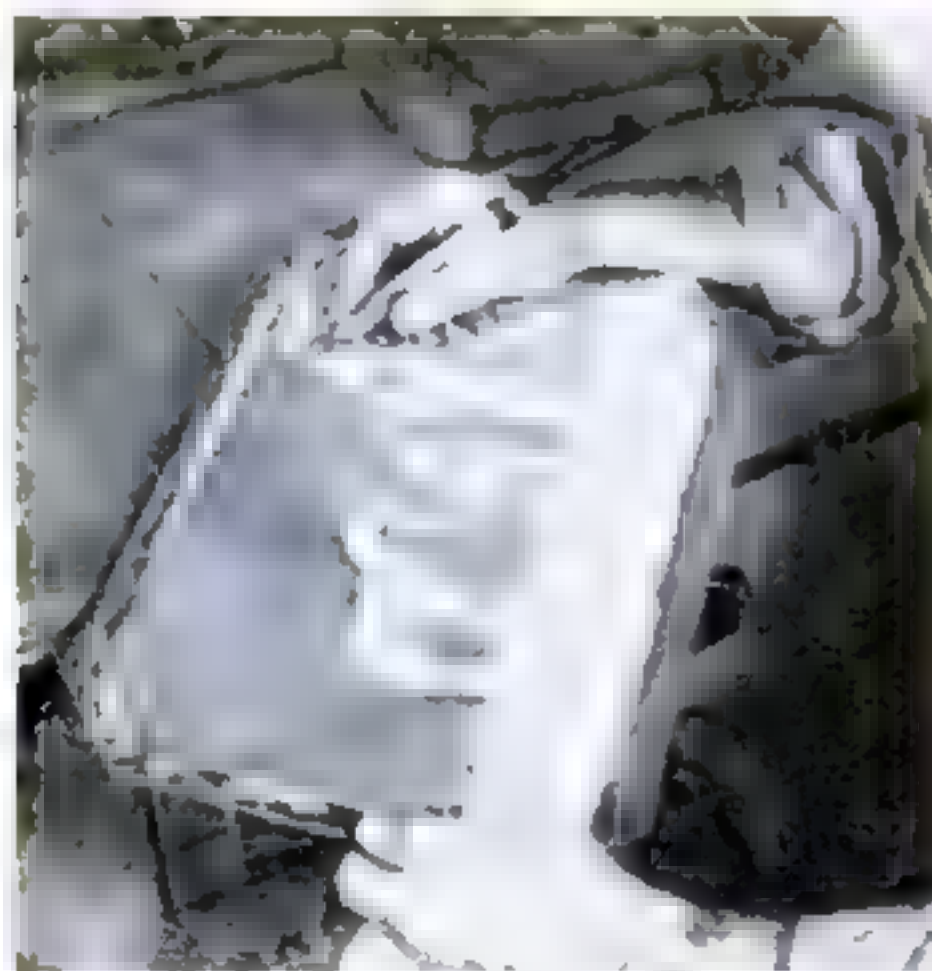
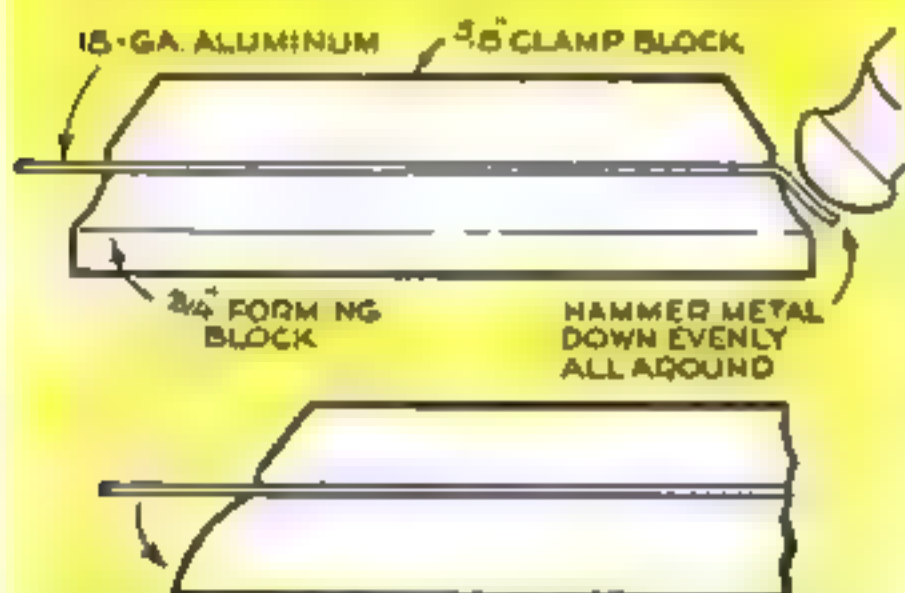
can make the blocks yourself to any contour and use them over and over to turn out duplicates. Soft sheet aluminum is the ideal material because it can be shaped and engraved easily, and given a handsome finish.

The dental burrs can be ordered from most tool suppliers—or you can ask your dentist to save his old ones for you. They'll still be plenty sharp for engraving.

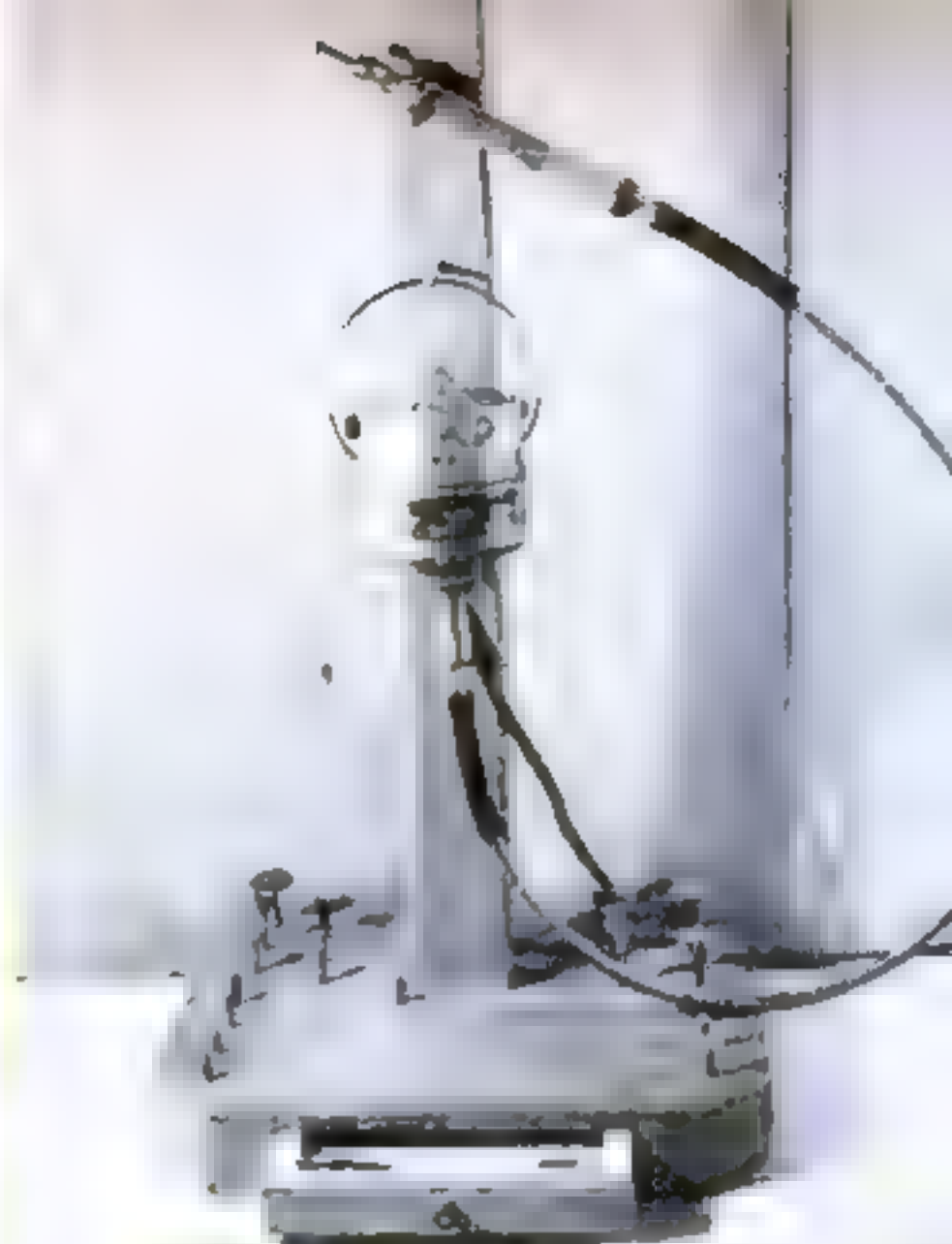
A special stand, designed for hobby work with a flexible shaft, provides a mount for the motor, and keeps the tiny



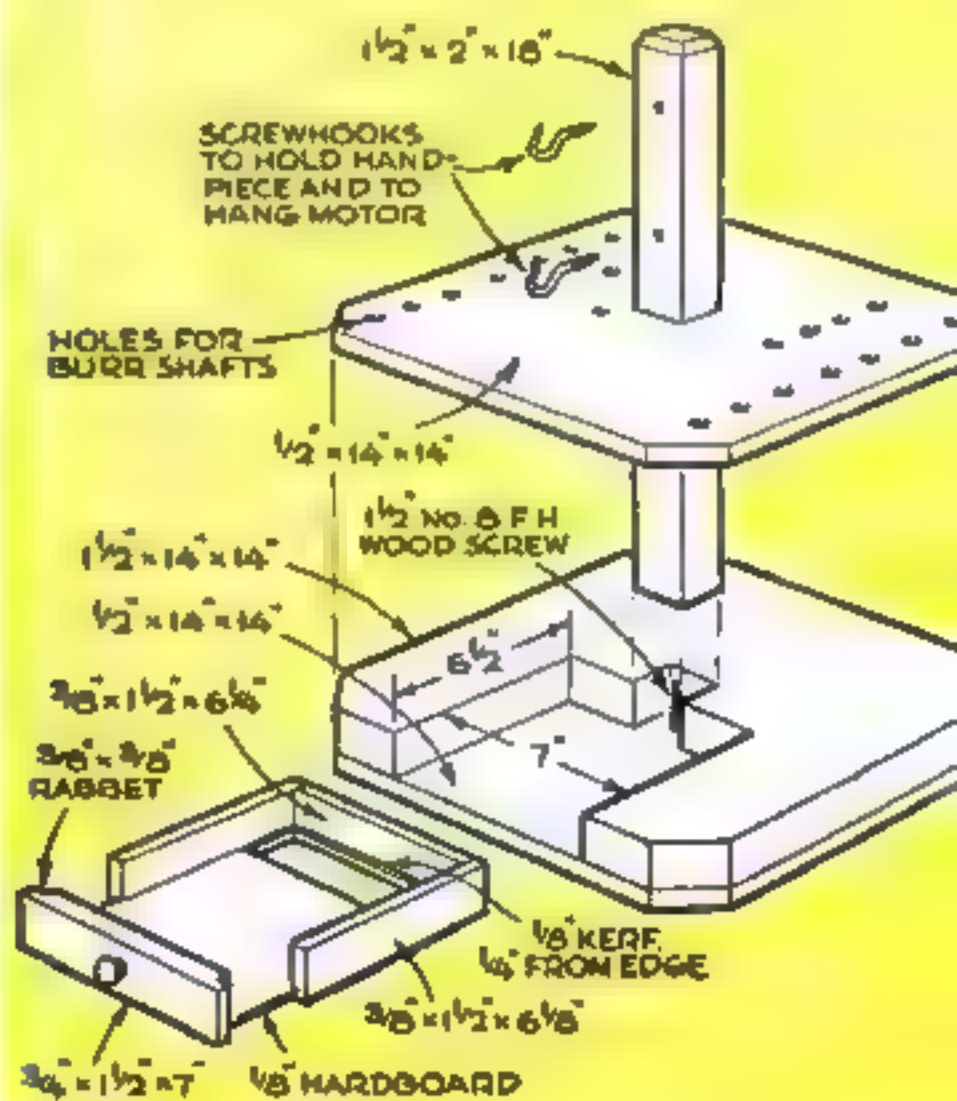
THE FORMING SANDWICH—aluminum sheet between wood blocks—is held in a vise for working. Secure top with a C clamp while hammering rim down over the forming block.



SILHOUETTING THE PATTERN by engraving the entire background gives another type of design. The metal surface has been coated with white paint to permit tracing the pattern onto it.



FLEXIBLE-SHAFT CADDY assembles all cutters, collets, and grinding stones for handy selection, and provides a drawer for small tools. Pick it up by the shaft and set it down anywhere near an electrical outlet. If your tool doesn't have a hang-up motor, alter the dimensions of the platform so you can fasten the motor to it.



cutters from straying. Plans for making it are on the facing page.

The engraving is done first, with the blank still flat. The different diameters and shapes of dental burs give varied effects. Two ball cutters produced the nesting flamingo shown here; their diameters were .030" and .053". Make a full-size pattern of this design (or one of your own) on a sheet of typing paper. To transfer it to the blank, apply a thin coat of flat-white oil paint to the aluminum surface and trace the pattern onto it with carbon paper.

Chuck your largest cutter into the handpiece and carefully cut all heavy outlines. Use a smaller cutter for the finer lines and shading. When the design is completely engraved, remove the paint with lacquer thinner.

Faster shaping. The usual forming method is to expand a flat sheet by hammering on the inside of the curve. Instead, I compress it over a forming block.

Shape a block from solid maple or birch plywood to the contour you've chosen for your tray. For a round tray, this is best done on the lathe; shape rectangular blocks with a plane or file.

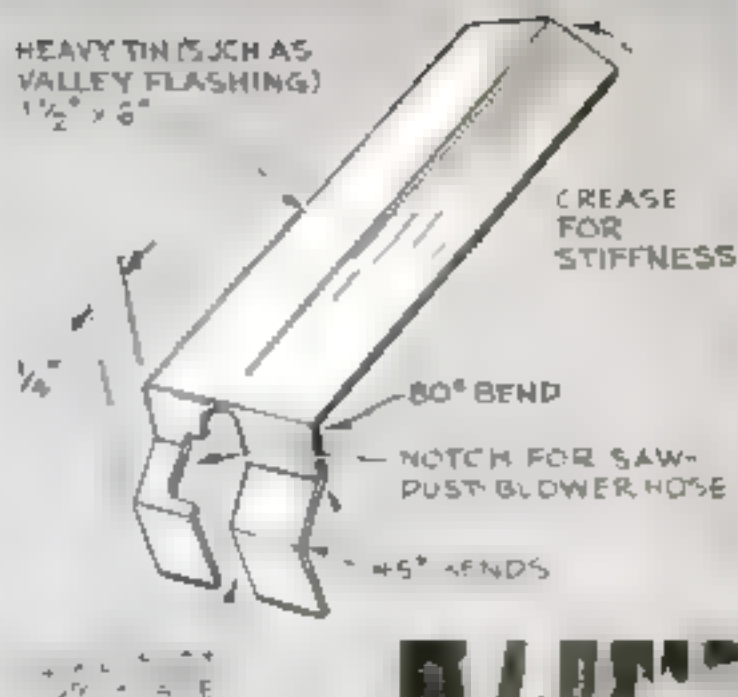
On your first try, don't plan on a rim of more than $\frac{1}{2}$ " to $\frac{3}{8}$ ". With experience, you can attempt deeper trays, and can even make bowls by partly forming them over a shaped wood block, then drawing the top in by hammering from inside.

For the flamingo tray, I cut an aluminum disk $10\frac{1}{2}$ " in diameter and raised a $\frac{1}{2}$ " rim. Two sample profiles for forming blocks are shown at far left.

To form the tray, you'll need a specially prepared ball-peen hammer. Round its planishing end slightly on a grinder. Then, using fine emery paper, polish both ends to a scratchless surface. A rough-faced hammer will scar the work.

Alternating between the ball and planishing ends, hammer the rim against the forming block, being careful not to let the metal buckle. Trim off any excess and file the edge smooth.

The design will stand out boldly if you dip a soft cloth into flat-black enamel and rub it over the engraving. Then dampen a cloth with turpentine and wipe the surface dry. If scratches appear, sprinkle flour-fine emery dust onto the damp cloth. Rub with a rotary stroke for a velvety finish. ■ ■



Blade Guard for Jigsaw

THIS simple-to-make accessory masks the noncutting section of a jigsaw blade and makes the tool safe enough for the smallest fry.

It raises automatically with the blade-guide foot, slips on and off in seconds, and doesn't impair visibility of the cutting line. The slotted foot fits between the washer and nut that hold the guide in place.—Gordon Nelson, Gladstone, Mich.



Handles to Lift Linoleum

TABS of newspaper, folded into a corner before you press linoleum down for a trial fit, make it easier for you to lift the edge again for trimming, or to apply cement underneath.—William Swallow, Brooklyn, N. Y.

Short Cuts and Tips

FROM PS READERS

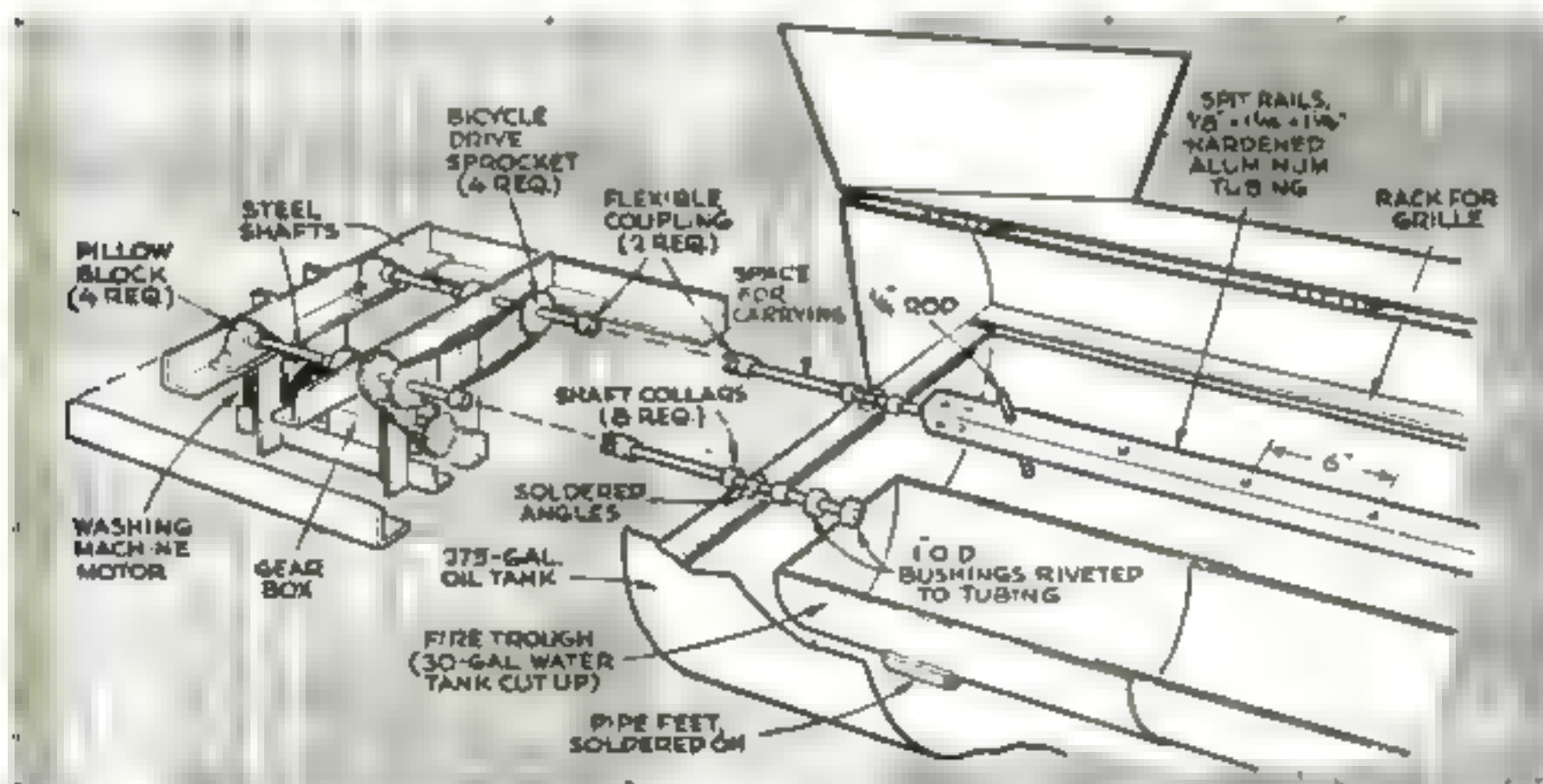


King-Size Rotisserie Made from an Old Oil Tank

MANY customers of my meat market entertain outdoors in a big way. But they lack facilities for cooking whole pigs or large orders of chickens and steaks. To stimulate business, I designed two charcoal ovens from salvaged oil tanks. One has two spits rotated by a $\frac{1}{4}$ -hp. washing-machine motor connected to a gear reducer. It can take two 70-lb. pigs or lambs. A three-spit version is powered

by a $\frac{1}{10}$ -hp. gear motor. Spits make six or seven revolutions a minute.

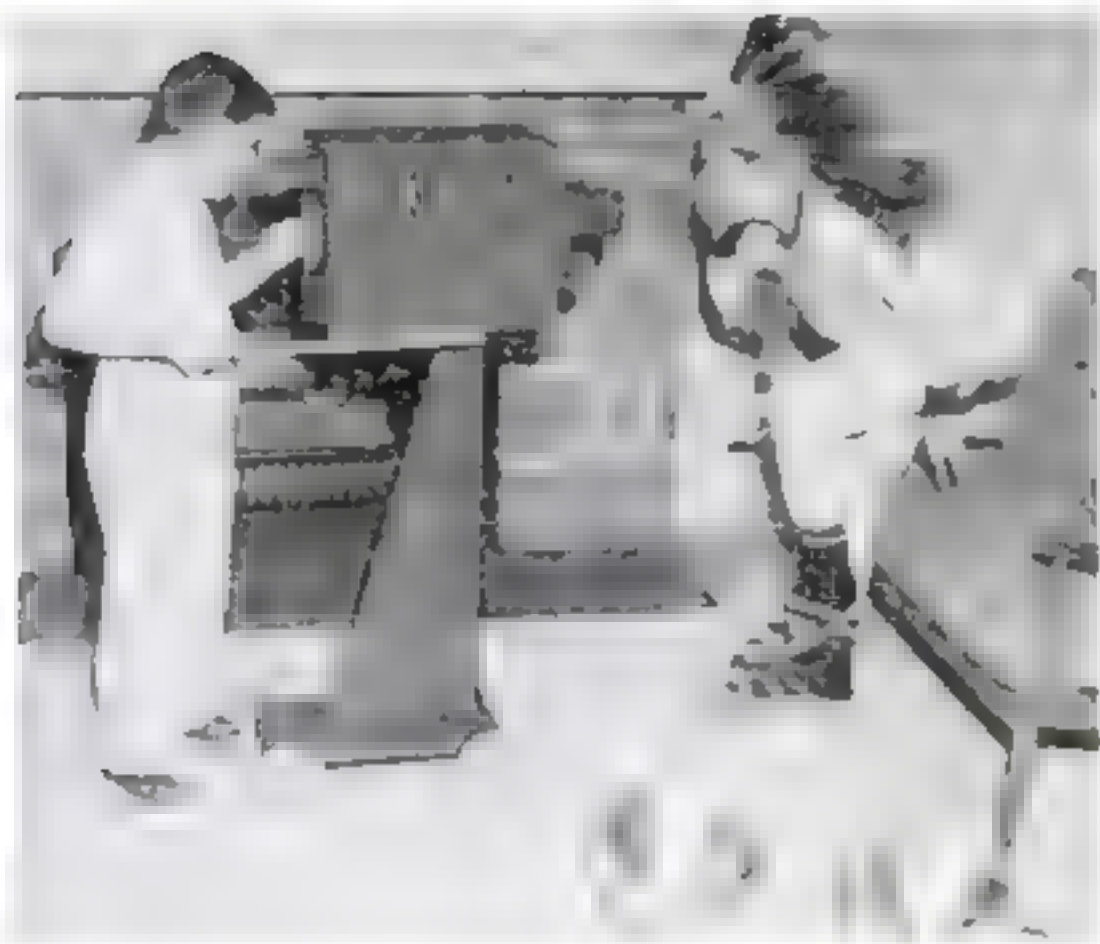
Square tubing keeps the meat from slipping. Couplings permit the spits to be brought to the table for carving. I also provide grills (which lie over the spits) for broiling up to 200 burgers or chops. The ovens are on casters so they can be wheeled onto a trailer for easy delivery.—
George Snoboda, La Grange, Ill.



▶▶▶TO RE-INSULATE the wires of a small rectifier, I used plastic clothesline with the cord pulled out. I've also used the plastic sheathing of No. 10 TW electric wire; I skinned off an inch of insulation and clamped the end of the copper wire in a vise to pull the plastic free. This method works only on short lengths.—
H. C. Sinner, Northfield, N. J.

▶▶▶BORROWED tools come home faster if your name is permanently etched in the steel. Clean the surface and coat with melted paraffin. Scratch through to the steel with a sharp scribe or stylus and apply iodine to the lettering. After a few minutes, wash with water, scrape off the paraffin, and wipe with an oiled rag.—
Rob J. Russoli, Cle Elum, Wash.

My PRIZE project is...



...a kid-size TV camera

We can't tear our youngsters away from television—only now it's this toy TV camera for make-believe acting and directing instead of the real thing. The dummy camera is just a box on a stand, but has a realistic-looking three-lens turret (cardboard mailing tubes on a plywood disk) and wheels for making those dramatic "dolly" shots. The station's call letters are—naturally—KID-TV.

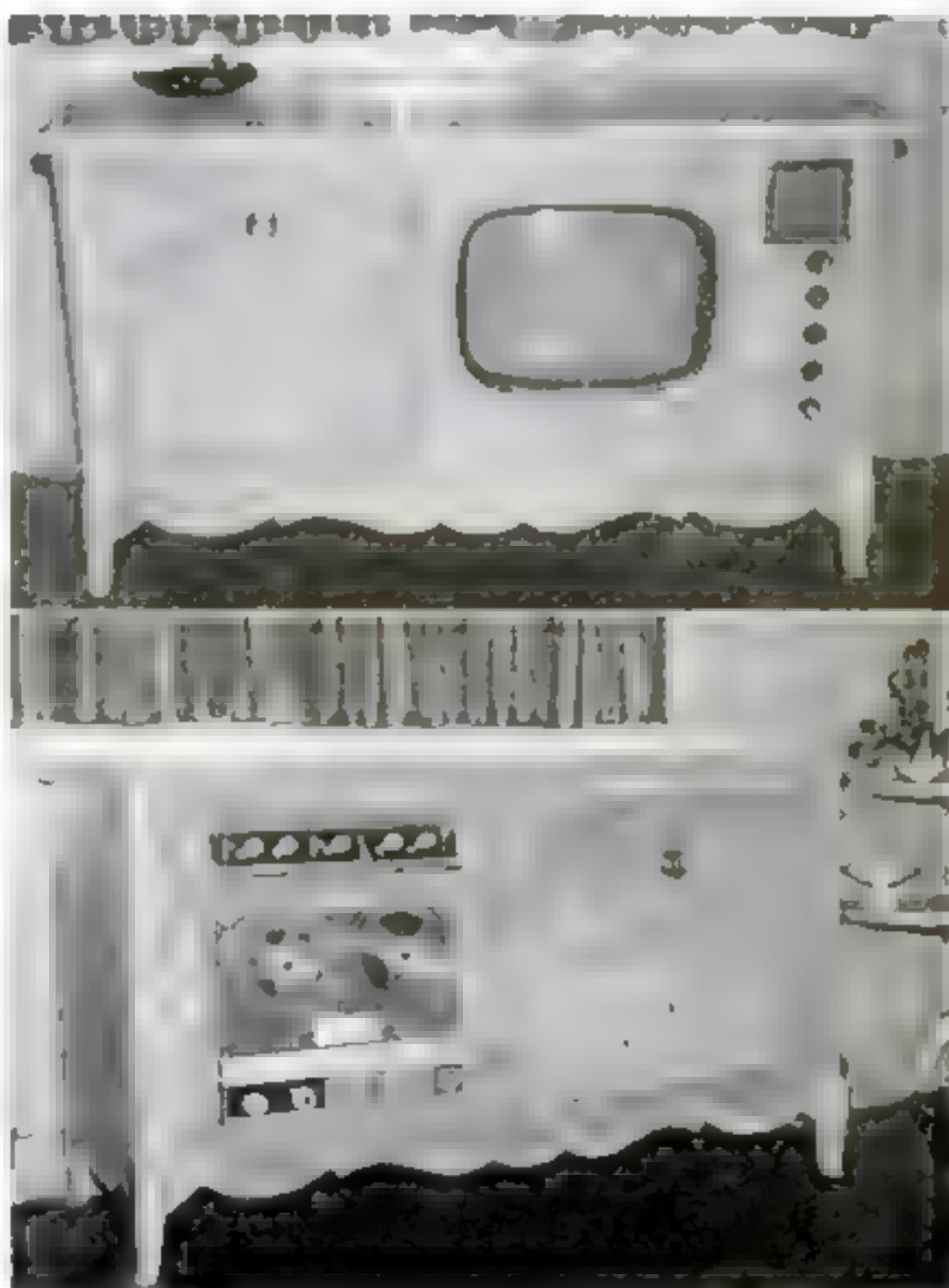
L. ROTHMAN, McKeesport, Pa.

...a matching pair of hi-fi cabinets

We wanted to house all of our hi-fi equipment in two matching provincial-style cabinets, but it was practically impossible to buy any big enough. So we designed and built the pair you see here.

The top one contains the TV set, a radio tuner, and a speaker; the bottom one a tape recorder, amplifier, turntable, and a second speaker. The two speakers work independently or can be adapted quickly to stereo. The part we're proudest of, however, is the cabinetwork. Each piece was painstakingly glued up and shaped from strips of white oak flooring that we salvaged from a wrecked farmhouse. The wood is beautifully seasoned and should be—the house was more than 100 years old.

IRVING SHEER, Roanoke, Va.



Short Cuts and Tips

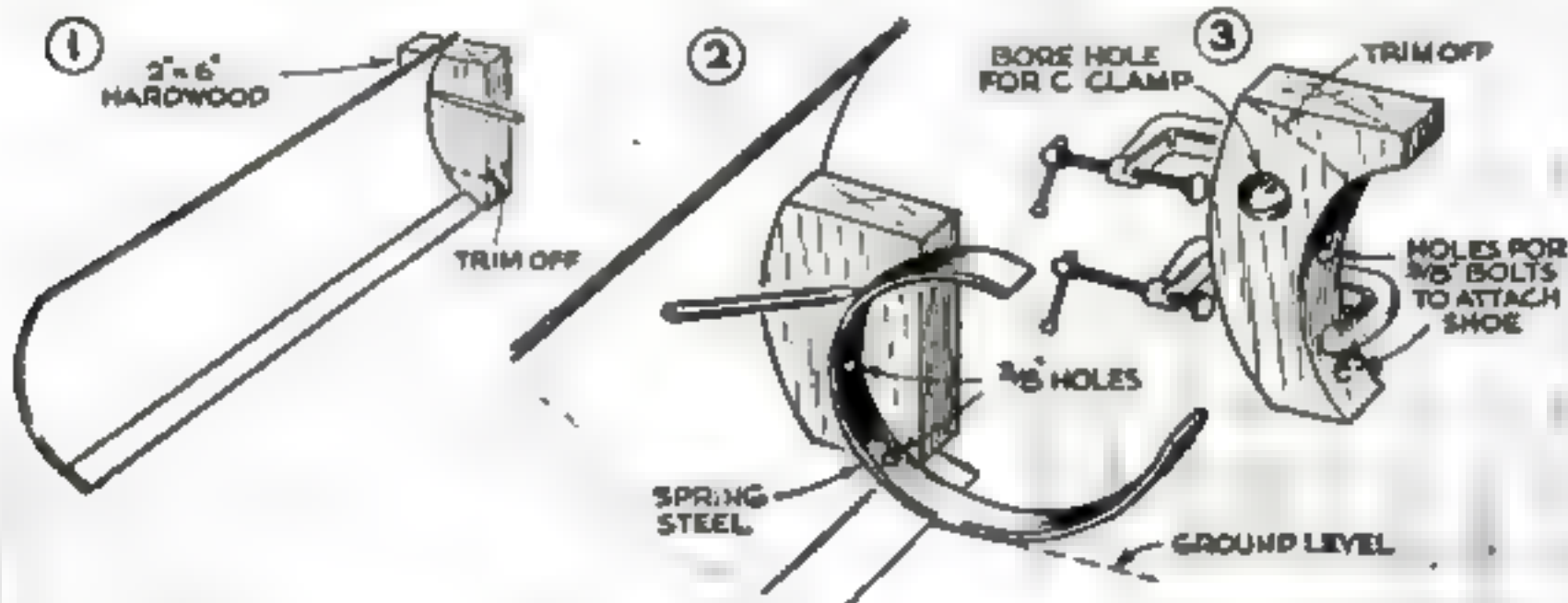
FROM PS READERS

Safety Shoe for Snow-Tractor Blade

You're risking hidden dangers when you push your snow tractor down a walk or driveway. The leading corner of the blade can catch on a heaved joint or other obstruction. The jolting stop could injure you or damage the equipment.

I attach this safety shoe, which can be a spring tooth from a farm harrow, or a reshaped and tempered leaf from an auto

spring. It rides in front of the blade to lift it over danger spots, as the photo shows. —Charles D. Fitzgerald, Midland, Mich.



BRACKET BLOCK must conform to curve of snowblade and shoe. Set block against leading edge of blade (1) and scribe along concave face. Cut away waste and hold block against blade while positioning shoe (2). Corner of

blade and bottom of shoe must rest on same plane. Scribe along back of shoe and make second cut. Bore holes in block (3) and bolt shoe to it, recessing bolt heads in back edge. Clamp unit to blade with two C clamps.

Rifle Cleaner Fits in Pocket

You don't carry your rifle-cleaning rod into the field. But here's a handy gadget you can stuff in your pocket for quick cleaning till you get back home. Crimp a few inches of bead chain onto 3' of cord or twine, and tie a scrap of soft cloth at the other end. Drop the chain into the barrel and pull the rag through. —John Middleton, Atlanta.





A Sure Cure for a Sagging Floor

By John Burroughs

SOME floor sag is inevitable as a wood-framed house with a basement grows older. The amount depends upon quality of construction. Even a little sag can cause maintenance problems.

Fixing a away-backed house isn't a one-evening job. But there's a slick trick often used by pro home remodelers—building a husky load-bearing cabinet in the basement to shore up the floor framing above. Such a cabinet can add years to



A load-bearing basement cabinet solves the problem—and gives you a lot of storage space

CONTINUED

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Steps in building a structural cabinet to support a sagging floor



DIMPLE THE FLOOR with a good-size masonry bit as the first step. The concrete base for the structural cabinet will then bond securely to the floor. Put dimples about 1" apart.



POUR A CONCRETE BASE 3" high and almost as wide as the front-to-back cabinet depth that you plan. Slant the form inward. Use a jack post (foreground) to level girder overhead.

the life of a house. It's also ample underpinning for any weighty new equipment upstairs—piano, washer-dryer, refrigerator.

Why does a floor sag? Examine the framing system holding it up, and you'll see. The key member is a heavy girder, either a built-up or solid timber. This beam, perhaps together with one or more auxiliary girders, is the backbone of your house. The girder ends generally rest upon or are set into the concrete foundation walls. Posts provide intermediate support.

This girder carries floor joists (two-by-eights, two-by-tens, or two-by-twelves) on 16" centers. Spaced with bridging to increase their load-bearing capacity, the joists serve as the nailing base for a subfloor.

In most cases of floor sag, the girder is the culprit. If the girder sags, so do joists and flooring. A quick check with a string stretched taut along a bottom edge of the timber will show you whether, where, and how much the girder in your own house has sagged.

The ends of a girder resting on con-

crete foundation walls are of course well supported. And generally a girder is well supported in the middle of a basement—usually by two posts, one at the head of the basement stairs and another at the foot. If the girder holding up your floor has sagged, chances are the worst deflection will have occurred at the center of the relatively long span between one of the central posts and the concrete wall. In many houses this span may be as much as 10' or 12'.

Eliminating the sag. This obviously involves jacking up the girder and placing a support at the center of the span. If you're sure that at that point your basement floor will take a heavy load without cracking, you could simply add another post. But it's a safer plan to build a load-bearing cabinet—a cabinet extending from the wall to the center of the sag—to serve as a structural support. The cabinet distributes the load over a much larger floor area.

Use a jack post or builder's jack to raise the girder to proper level. Turning up the jack screw very gradually—a quar-



CEMENT THE PLYWOOD to the adjoining concrete wall and the base, using sawdust mixed with epoxy resin as the adhesive. Glue and nail the top piece of plywood to the girder.



USE A DOUBLE THICKNESS of $\frac{3}{4}$ " plywood for top, bottom, ends, and uprights. Set inside pieces $\frac{3}{4}$ " from rear edge to form rabbet for inset plywood back. Set them flush at front.



EVEN OFF FRONT of the cabinet framing with coarse-grit sander after installing all the members—doubled horizontal dividers and $\frac{3}{4}$ " shelving. Butt back panels along one upright.



SET DOORS against tacked-in stops. For best appearance, bullnose all outside frame edges slightly and fillet inside corners with wood putty. Install shelves with glue and nails.



FINISH OFF THE CABINET as desired after you have removed temporary jack post. This cabinet was finished in coffee-colored gloss enamel with rose semigloss on the doors.

ter-turn a day for a week or more—minimizes the risk of cracking plaster upstairs.

Pour a 1-2-3 mix concrete-slab footing for your cabinet, making the slab the same height as existing post footings. Damp-cure the green concrete for at least a week before you begin building the cabinet itself.

For safety's sake—unless you're an experienced engineer who can calculate structural loads accurately—overbuild your cabinet. Build it solidly enough, that is, to support a load far greater than it will actually bear.

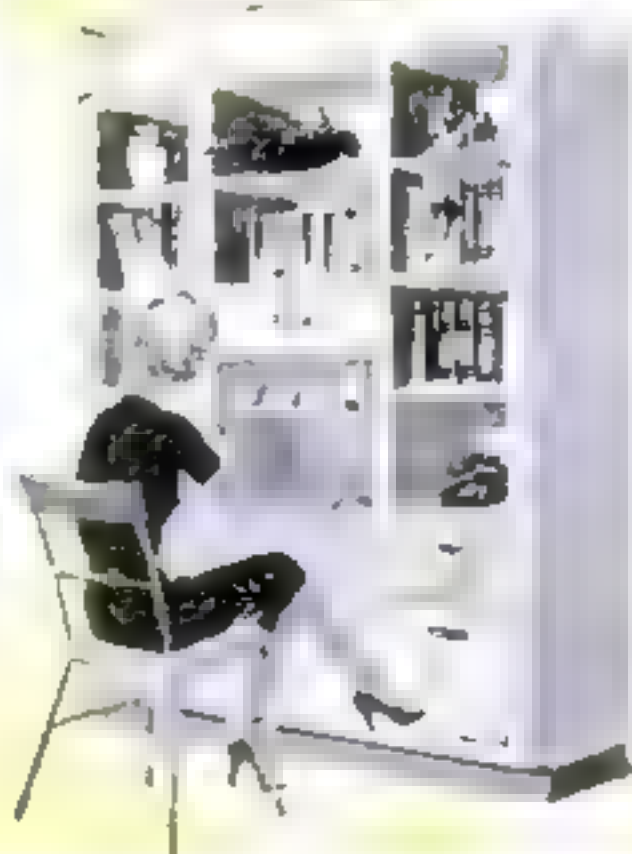
You'll be doing exactly that if you build an all-plywood cabinet like the one shown. A pair of box columns separated by an open bay, this unit will safely take the weight of any two-story frame house. Make it 12" to 18" deep, with the box columns no more than 18" wide and the bay separating them no more than 24" wide.

The cabinet was designed for storing tools and shop supplies. Using the same sturdy construction, you could build a parts-drawer cabinet, a shop-reference library with drop-front desk, or a cabinet-and-workbench unit.

The cabinet might serve these purposes, too



PARTS CABINET
WITH DRAWERS AND
OPEN SHELVES

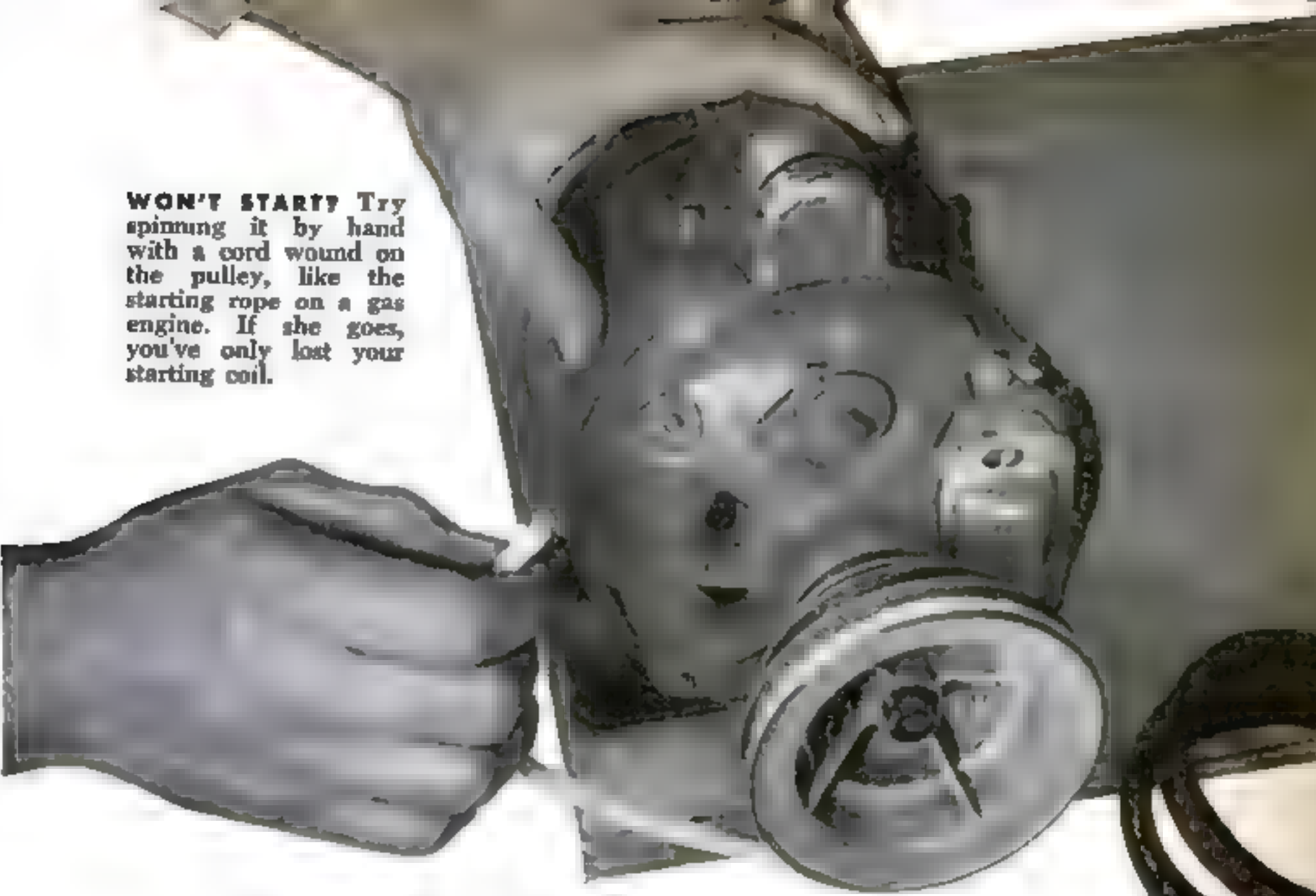


BOOKSHELVES WITH
FOLD-DOWN DESK



TOOL STORAGE WITH
FIXED BENCH TOP

WON'T START? Try spinning it by hand with a cord wound on the pulley, like the starting rope on a gas engine. If she goes, you've only lost your starting coil.



Nine times out of ten, a "dead" power plant is just playing possum. Here's a simple, symptom-by-symptom guide for—

Putting a Balky Motor Back to Work

By Joe W. Rocke

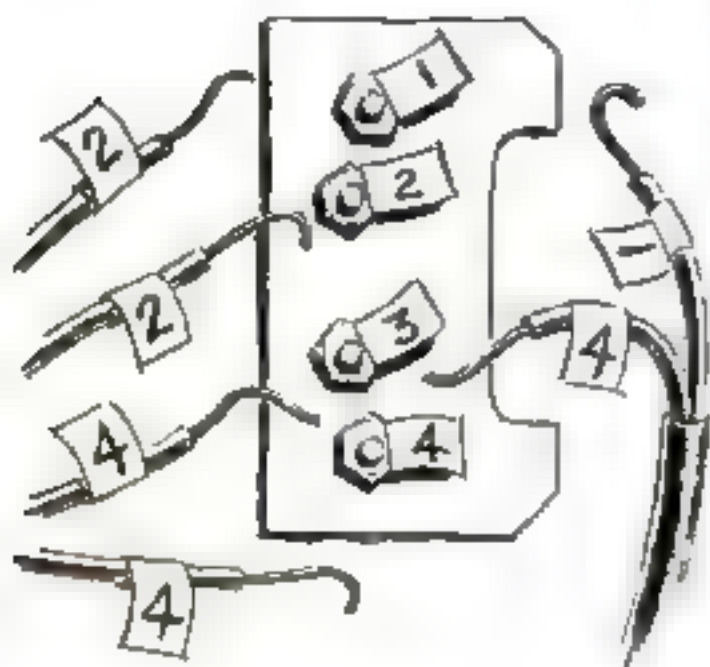
MANY "dead" motors are thrown on the trash heap or sent to the shop for expensive repairs when all they need is a few minutes' work to put them back on the job. Complete burnouts are actually rare. Most of the time, it's merely a matter of tightening a loose wire, unsticking a switch, or replacing a brush—troubles that can all be spotted by the simple tests shown here.

There are only three basic types of

household motors that you'll normally have to contend with—the split-phase, capacitor-start, and universal. You'll find the split-phase and capacitor-start on major appliances, such as washing machines and stationary power tools. If you run across the rarer two-capacitor type, just remember that it's similar to the capacitor-start except that it has a second capacitor in the running circuit. Portable tools and small appliances such as vacuum cleaners generally use universal motors. Their brushes make them easy

CONTINUED

How to check continuity with a bulb tester



LIGHT BULB, wired in series with a 110-volt source and a pair of test clips, will tell you if current is getting through individual parts.

to spot—and are also a chief cause of their ailments.

By using the following check list, you'll be able to track down—and cure—the most common motor troubles yourself.

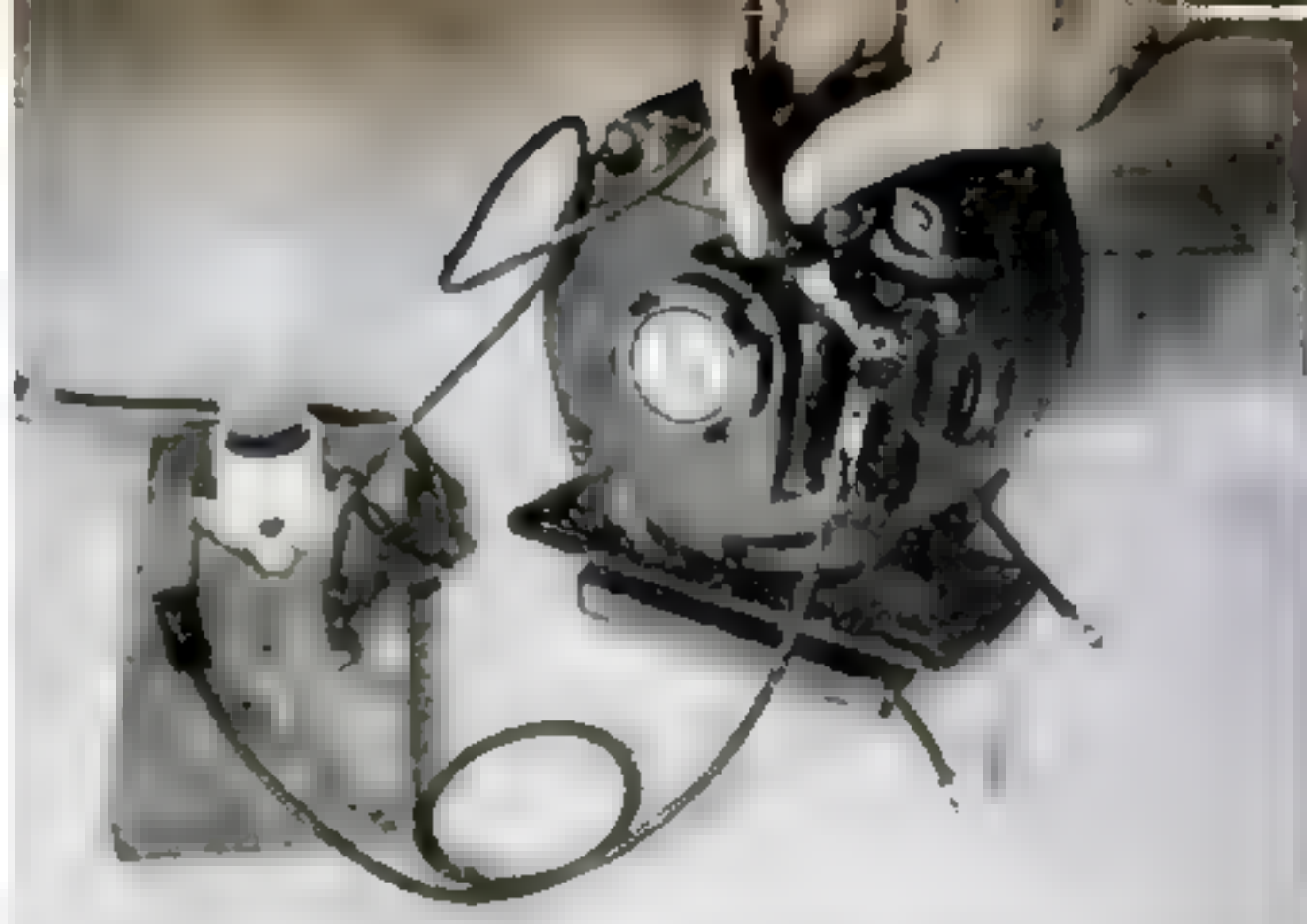
SYMPTOM:

Motor hums but won't start

Possible causes: 1. *Motor overloaded.* Try the motor with the load disconnected. If it starts and runs normally, the drive belts may be too tight or the pulley ratios too high, causing an abnormal starting load. A variable-speed pulley or automatic clutch may be the answer here to pick up the load gradually. Also check the motor shaft for excessive side play that may be allowing the rotor to bind under load.

2. *Open circuit in starting winding.* Spin the motor shaft by hand with the switch on. If the motor starts and runs normally, you've lost only your starting power. Capacitor-start and split-phase motors have a centrifugally operated switch that cuts in an extra coil during starting, then cuts it out as the motor reaches running speed. Check for an open circuit in the starting winding by making a continuity test, using a light-bulb tester as shown above.

If continuity is okay, the trouble may be in the centrifugal switch. Carefully



First remove wires from motor's terminal strip and number them for identification. Then touch terminals to see if bulb lights.

remove the motor bells (end plates) and check the switch points for poor contact and the centrifugal throw-out mechanism for weak or broken springs that may not be holding the switch closed during starting. Finally, check the capacitor itself for an open circuit as shown.

3. *Open circuit in running winding.* If the motor can't be started by hand but hums, check for an open circuit in the main running winding by making a continuity test the same way as for the starting coil. Also inspect the coil and connections for visible breaks.

4. *Reversed polarity of stator poles.* This is very unlikely and could only happen if the coil windings had been worked on recently and improperly reconnected. Make a polarity test, holding a small pocket compass inside the windings as shown in a photo. Opposite stator poles should show opposite polarity.

SYMPTOM:

Motor runs but overheats

Possible causes: 1. *Motor overloaded.* Use an AC ammeter to check the motor's current draw when running free and then under load. An excessive jump in current draw under load indicates an overload. Also check heat rise by fastening a thermometer to the motor as shown. The temperature rise should not exceed the

amount listed on the motor's nameplate.

2. Starting switch fails to open. If this happens, the starting coil will continue to operate after the motor is running and cause overheating. Look for smoke coming from the motor. Check the switch points and centrifugal throw-out mechanism for free operation. You should hear a slight click as the switch opens, if it's working.

3. Shorted coil windings. Check the current draw again with an ammeter, as in the overload test. This time an excessive draw under free-running operation indicates faulty wiring. Feel the motor for hot spots. If one portion of the housing is warmer than the rest, a shorted coil is the likely culprit. Run a resistance check on the individual coil windings with a low-reading ohmmeter to spot the offender. Also inspect the coils for visible damage.

4. Low voltage. Measure line voltage under static and running conditions and compare readings with motor nameplate for correct operating voltage. Also check for wrong connections on terminal strip, especially on multivoltage motors. Be sure terminal screws are tight—loose ones make power-robbing, high-resistance connections.

Make certain, too, that your line cord



TO GET AT MOTOR'S INNARDS, remove housing bolts and gently tap off end bells, or plates. Mark position of the plates first with tape so they can be replaced in exactly the same way.

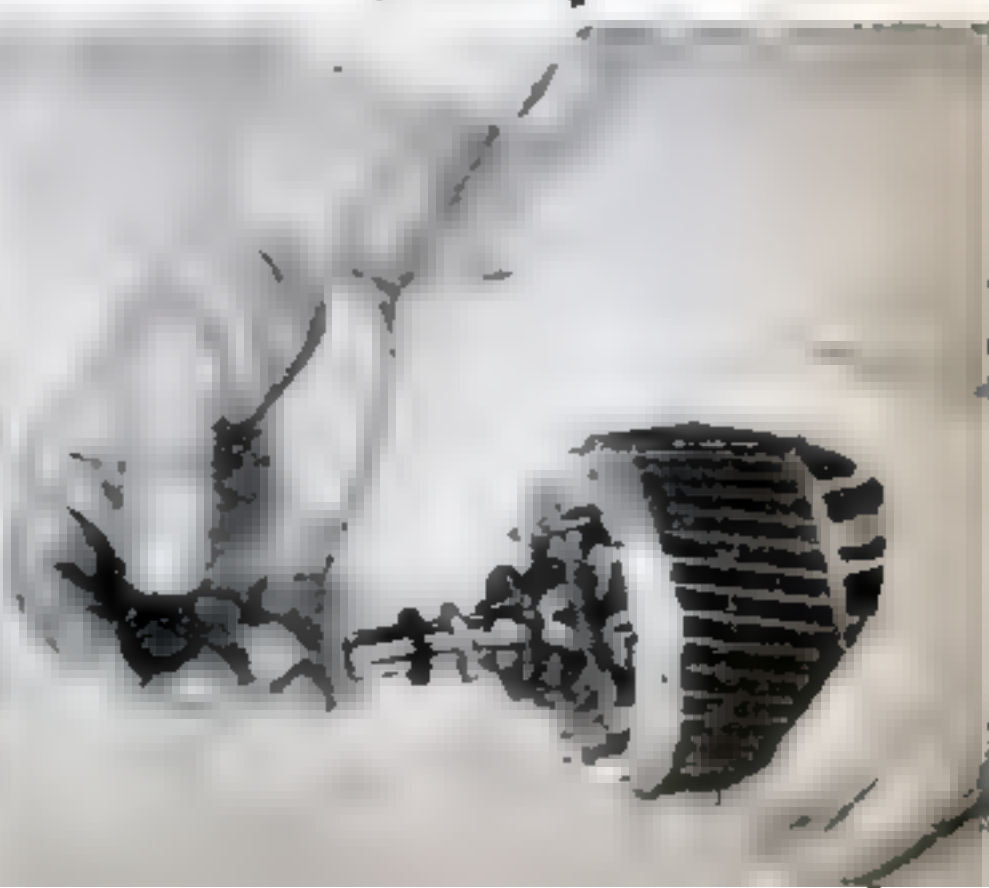
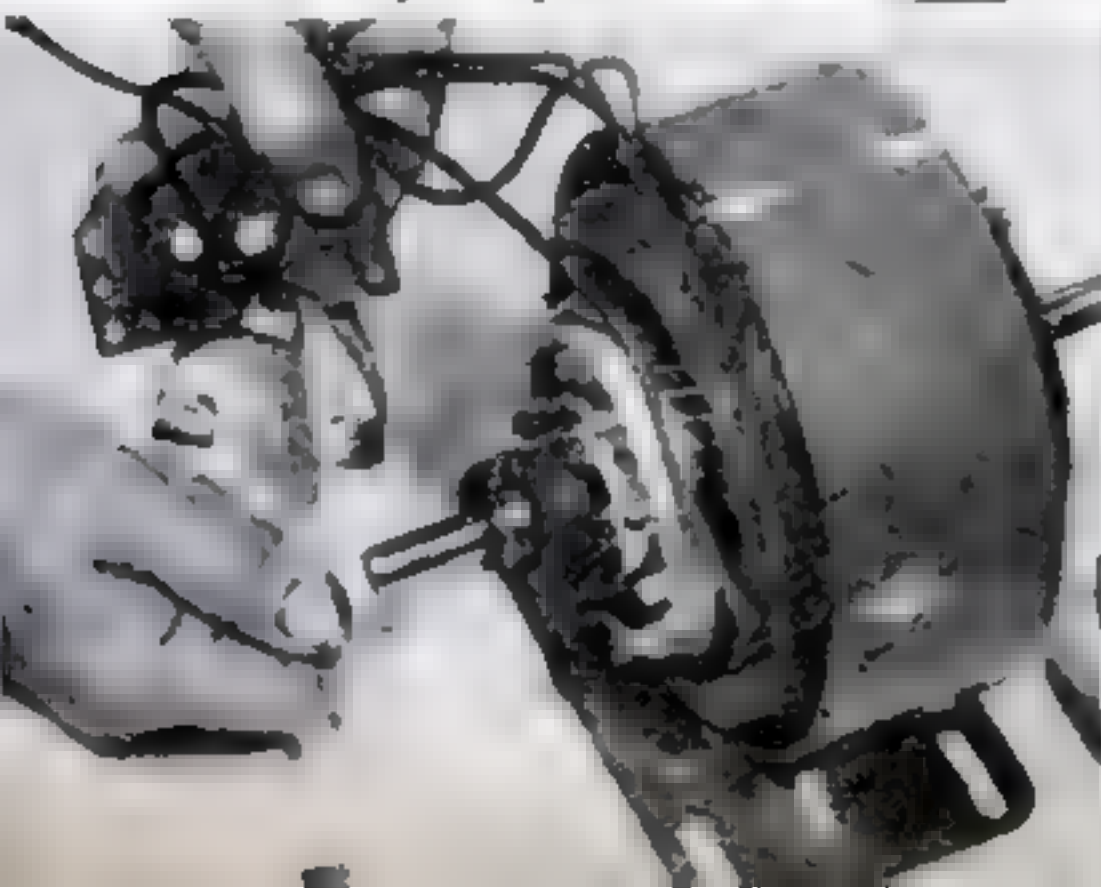
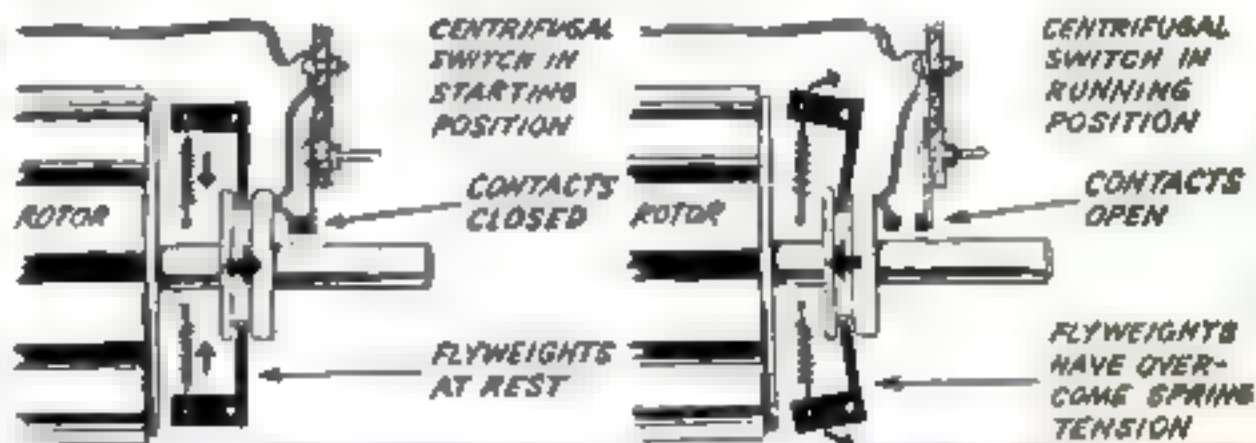
is up to handling the current your motor requires—the larger the motor or the longer the cord, the heavier it must be. Use the accompanying table to find the size you need. Never, in any case, run a motor farther than 200 feet from a power outlet. Finally, check the branch circuit that your motor is on for a possible overload elsewhere that may be affecting the motor.

5. Worn bearings. Excessive sloppiness here can permit the rotor to drag against the stator, resulting in overheating. Look for side play in the rotor shaft and for improper alignment of the end

CONTINUED

Trouble-shooting the centrifugal starting switch

SWITCH POINTS should open and close smoothly, as in sketches. If they don't, look for faulty springs, excess oil, or points welded closed. Clean points, as below, with a point file and sandpaper. Also check rotor shaft for worn shims, as below at right, that may cause excessive end play. Shaft play should not exceed $1/32$ " or the switch may not operate.



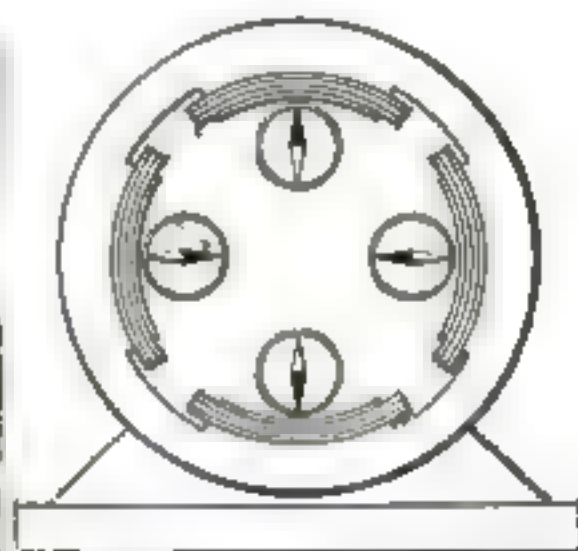


Tracking down a suspicious capacitor

FIRST CHARGE THE CAPACITOR with a momentary shot of DC voltage, as at left, using a low-value fuse in the line to protect it. (If AC is used, make charge very brief—just a swipe of

the contacts.) Then fire the capacitor, as at right, by shorting its terminals with an insulated screwdriver. If spark is weak or absent, have capacitor checked by a shop.

Making the polarity test with a compass



CONNECT COILS to low-voltage DC, such as a DC model-train power supply. Hold a compass near each coil and watch needle. Opposite coils should show opposite polarity, as in the sketch above.

plates. Check for clearance between rotor and stator with a feeler gauge if it can be inserted with end plates in place. If not, remove the end plates and examine the rotor and stator for visible signs of dragging. If worn brushes are indicated, they can be replaced, but this is usually a job for a pro.

SYMPTOM

Motor plays completely dead

Possible causes: Open circuits. First make the basic test of being sure the motor is plugged in—not as silly as it sounds. Then, using the light-bulb tester, run continuity checks on the following:



TAKE MOTOR'S TEMPERATURE if you suspect an overload. Fasten thermometer to housing with clay or tape. Rise in heat while motor runs should not exceed amount on motor nameplate.

power cord, motor switch, motor circuits at the terminal strip, and built-in overload protector. On two-capacitor motors, check the continuity of both capacitors.

SYMPTOM:

Motor runs but is noisy and lacks power

Possible causes: 1. *Worn bearings, faulty starting switch, or reversed polarity.* Make the same tests here as described for overheating: Check for bearing wear, dragging of the rotor, and failure of the starting-switch points to open. Also make the compass test for reversed polarity of coil poles. It's possible for a motor to run—but not well—with the coil windings improperly interconnected.

2. *Worn or dirty brushes.* In brush-type motors, look for weak spring action caused by brushes that have worn too short to exert adequate pressure on the commutator. This results in excessive arcing and loss of power. Also clean the commutator and make sure brushes slide freely in the brush holders. A sticking brush can act in the same way as an overly short one, failing to make proper contact with the commutator.

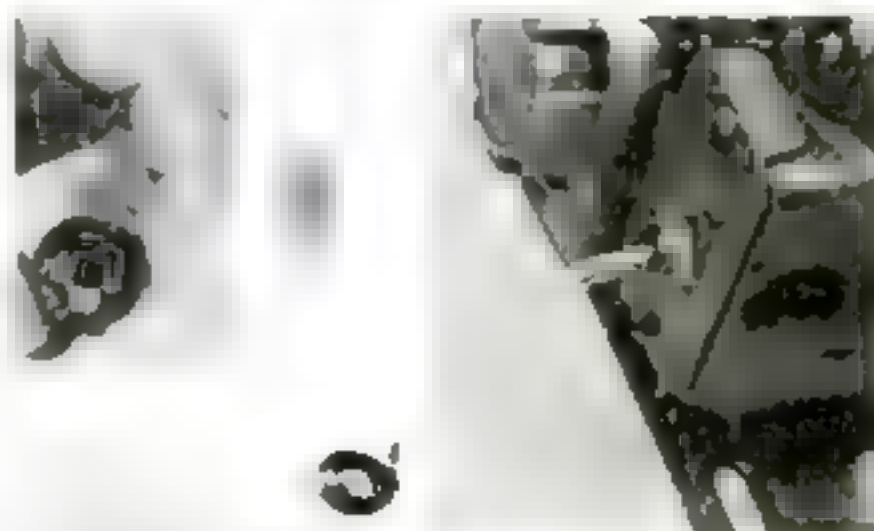
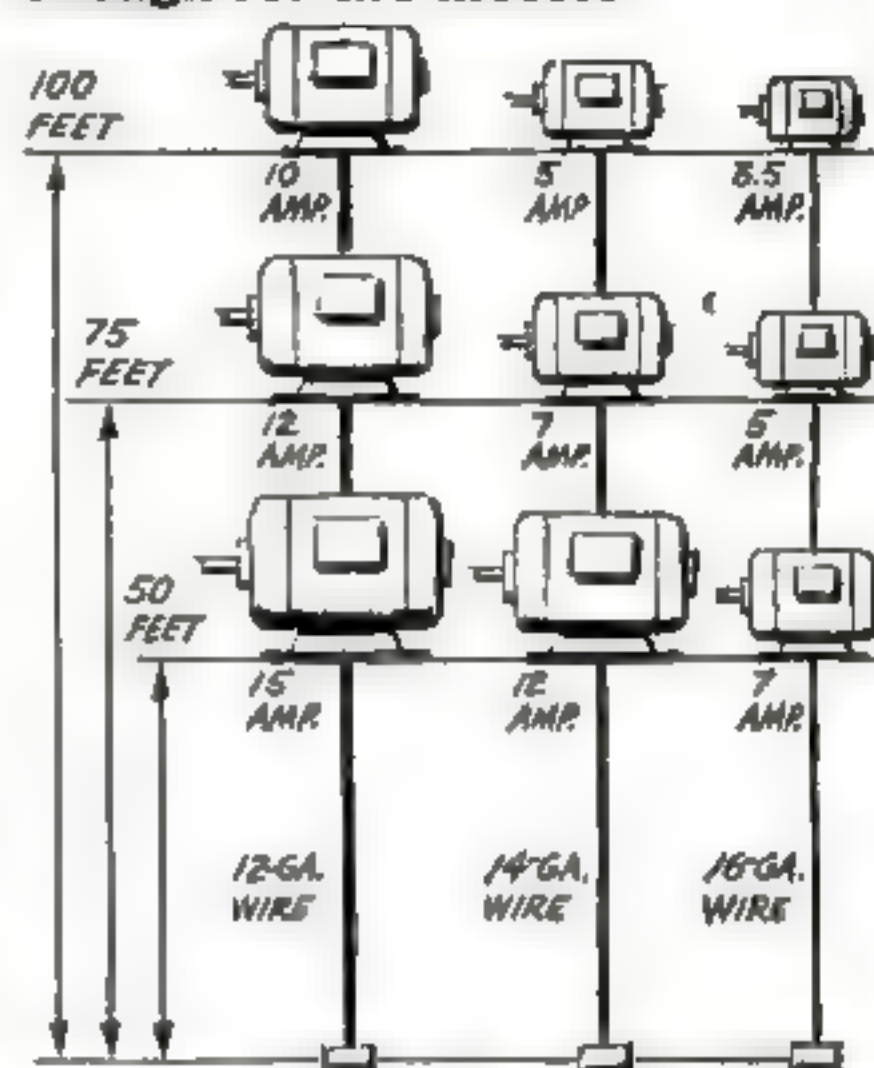
SYMPTOM:

Motor is sluggish, lacks power, and overheats

Possible causes: 1. *Motor shaft binds.* Spin shaft by hand to see if it turns hard. If so, check the shaft for bends, end plates for misalignment, and bearings for lack of lubrication.

2. *Shorts in motor coils.* Make a continuity check between the coil circuit and the stator frame. If bulb lights, it indicates that a winding has shorted to the frame. Also check for excessive current draw under free-running operation and for hot spots in the motor housing—both sure signs of faulty windings. Remove housing and look for bare or charred insulation spots in the coils. If all checks point toward an internally damaged coil, you've fingered the trouble and can turn the actual repair over to a pro. ■ ■

Is the power cord big enough for the motor?



OVERLOAD SWITCH consists of tiny heating coil and switch points that feed current to the motor. If motor plays completely dead, check for continuity through the switch.



BLAME WORN BRUSHES when small motors lose their muscle. Brushes that are worn short may not seat firmly on the commutator. Also clean the brushes and commutator with carbon tet.

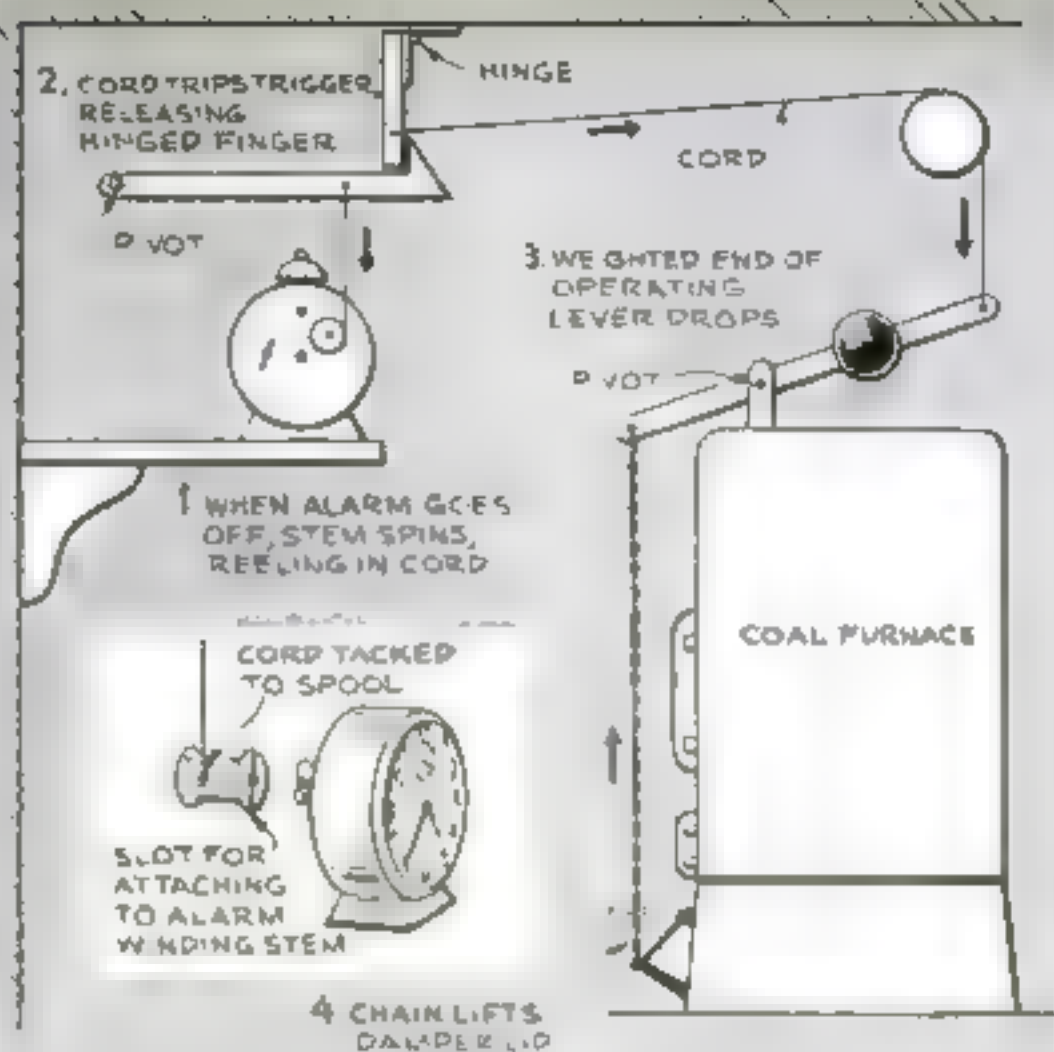
Short Cuts and Tips

FROM PS READERS

Alarm Clock Wakes Up Dozing Furnace

No MORE frigid morning trips to the cellar for me! My old-style coal furnace has its own alarm clock, set enough in advance of mine to assure a warm house when I get up.

I merely bank the fire at night and leave the damper closed. It opens automatically in the morning to start a draft that will bring the fire back to life.—*Joseph N. Parker, Richmond Va.*

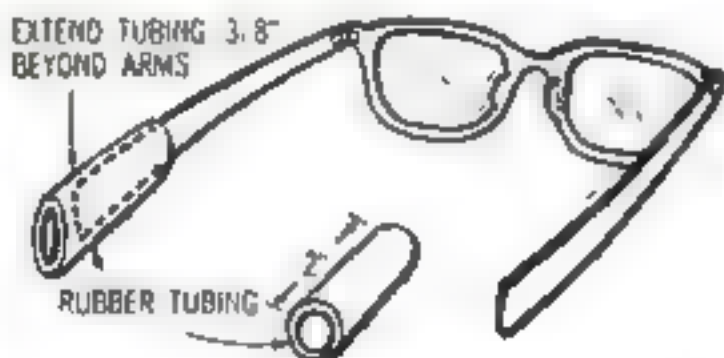


►►► I've found out how to keep battery terminals, bolts, and other fastenings on my car from corroding. I coat them with heated beeswax. I've driven 50,000 miles on one coating with no corrosion. Bolts and nuts are also easy to loosen because the wax lubricates the threads.—*R. M. Waddington, Port Arthur, Ont.*

►►► NAILING hardboard to ceiling joists, I found it necessary to predrill for easy driving. When I broke all my small drills, I was about to give up; then I found that those twist or roofing nails make good drills themselves. One of a smaller size than the nails being driven is best.—*Irving Benton, Vineland, N. J.*

Keeping Eyeglasses from Slipping Off

EYEGLASSES with straight arms often have an annoying habit of sliding down your nose when you bend over, especially if it's hot and you're perspiring. You can keep them in place by slipping short lengths of snug-fitting rubber tubing over the ends for a tighter grip.—*William G. Bunnan, NYC.*



Chip Shield for Star Drill

CONCRETE chips sent flying by a star drill can be dangerous. Protect yourself with a 3" disk cut from an old inner tube and slipped onto the shank, as shown. Keep the center hole small for a snug fit.—*Gordon Nelson, Gladstone, Mich.*

►►► BLINDED by sawdust when you use an electric sander? Slip on plastic swim goggles to protect your eyes.—*Marvin Sandomirsky, Regina, Sask.*

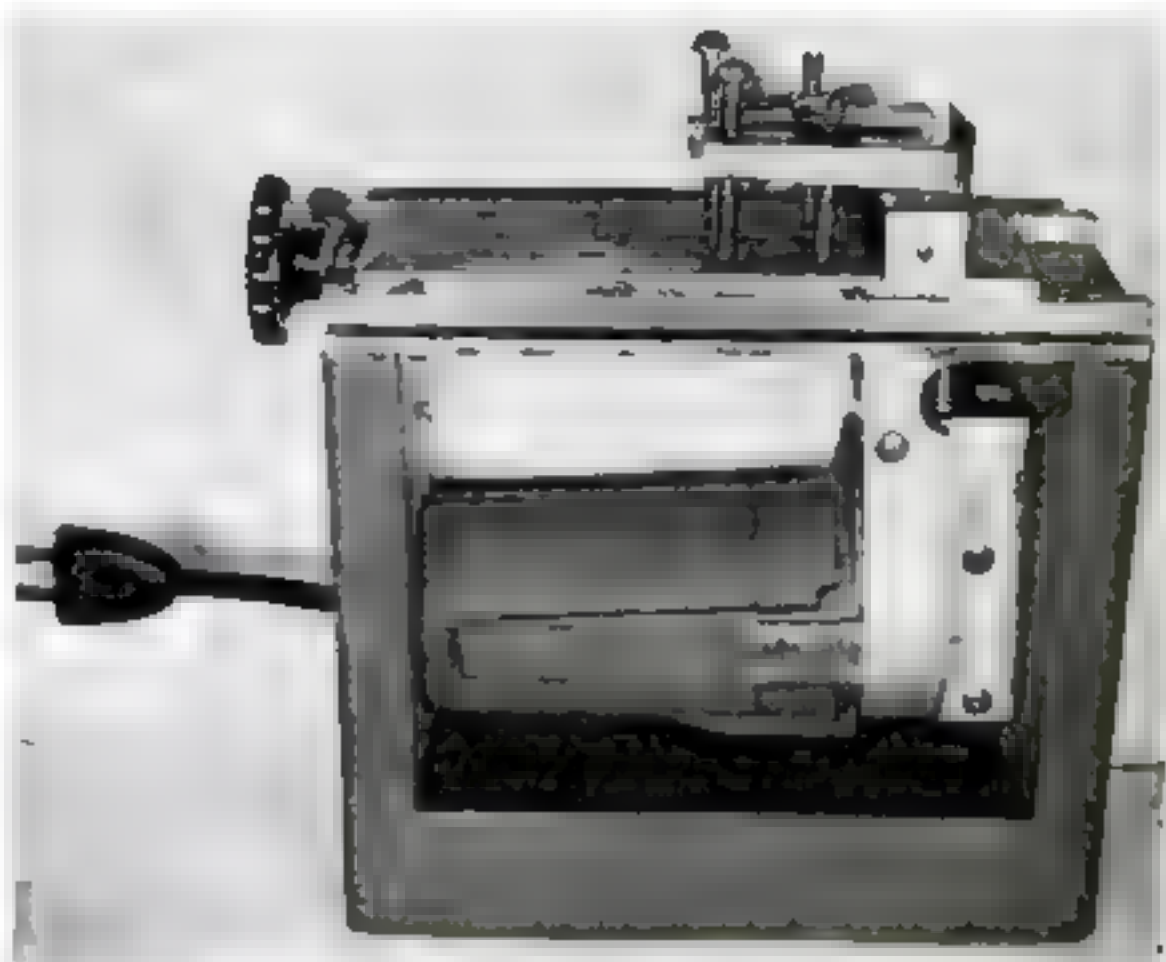
Power Hacksaw from a Saber Saw

CHUNKS of steel up to 1" thick whiz through this power hacksaw like logs in a sawmill. Actually, it's an ordinary saber saw built into a screw-feed bench stand. Instead of straining to hold the saw freehand, you clamp the work to a slotted slide and merely turn a knob to advance it into the blade.

The saw's regular shoe is removed and a $\frac{3}{8}$ " steel plate bolted on to form a table, with a metal-cutting blade projecting through a hole. The plate holds the saw upside down in a U-shaped wood cradle. The stand shown is $3\frac{3}{4}$ " wide, $7\frac{1}{2}$ " tall, and 8" long, but could be varied to suit any saw.

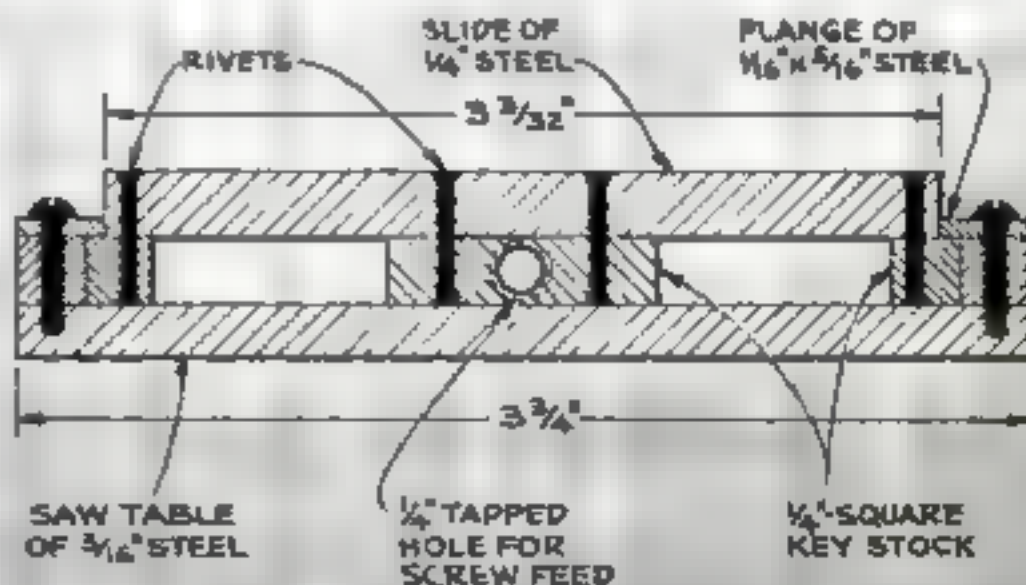
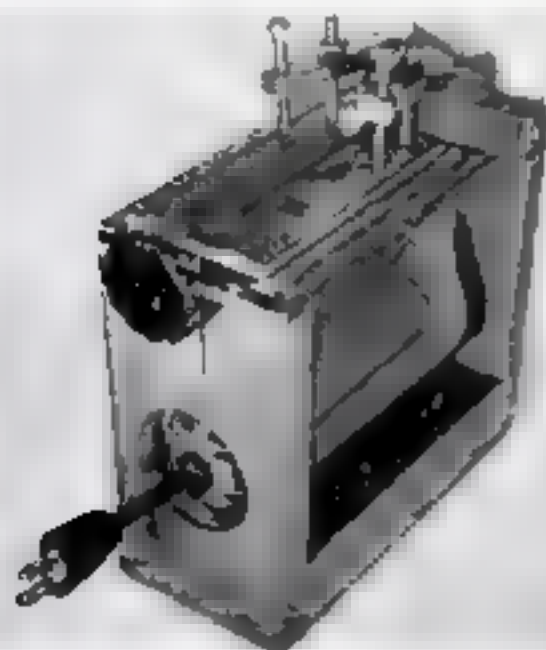
The slide is held by two L-shaped side rails built up from $\frac{1}{4}$ "-square key stock with slightly wider strips bolted on top to form flanges. The slide itself is $\frac{1}{4}$ " steel plate with $\frac{1}{4}$ "-square strips riveted along the edges. These are set out slightly to form shoulders that lock into the flanged rails on the saw table.

The screw feed is a $\frac{1}{4}$ " threaded rod fitted with an old radio knob and held at the back by a bracket screwed to the base. The front turns in a threaded hole in a small block riveted crosswise at the rear of the slide. A nut soldered to the

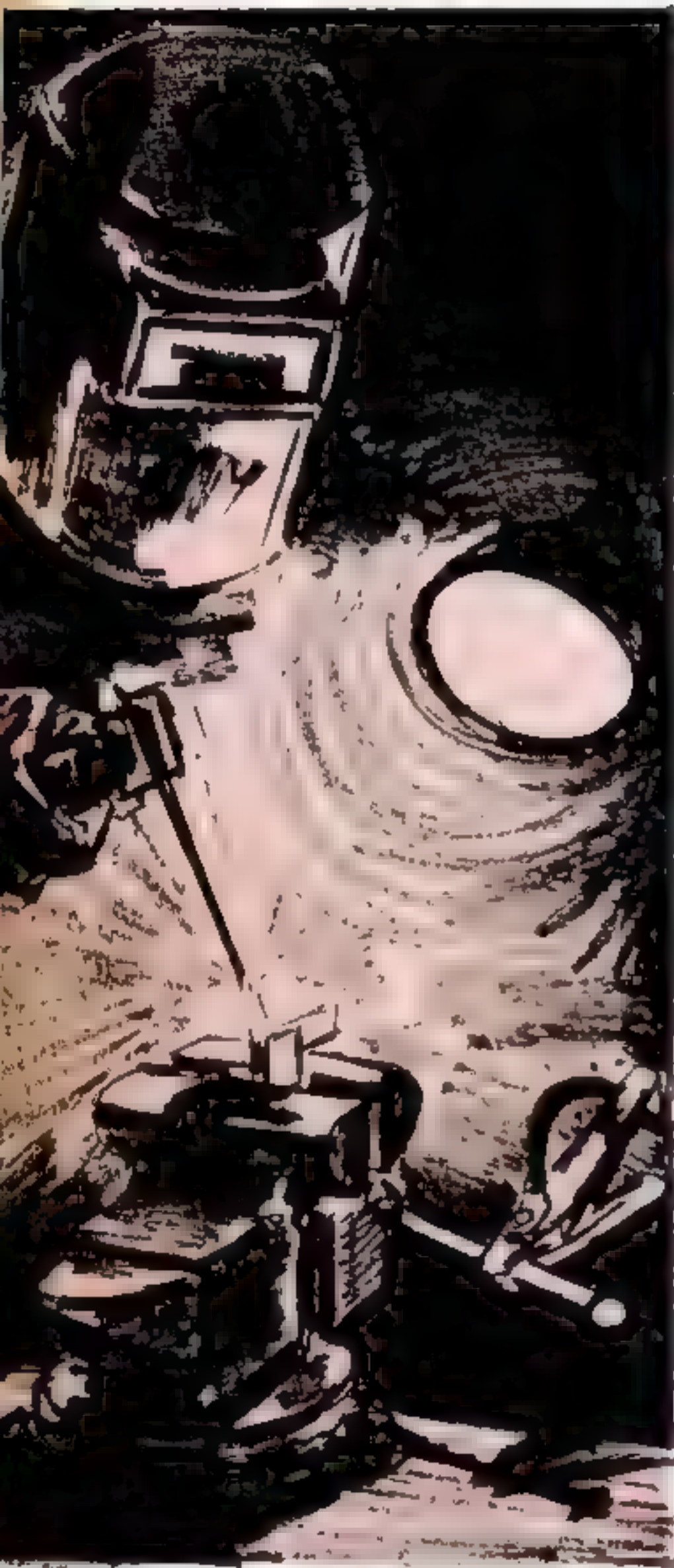


rod just ahead of the bracket forms a thrust bearing so the slide is forced forward as you turn the knob.

A slot in the slide provides clearance for the blade. This runs from a hole near the front to within 1" of the rear. You can locate it accurately by letting the saw itself make the first cut. Then remove the slide and enlarge the slot slightly. Tapped holes along the length of the slide enable you to attach clamping jigs at any point to suit a variety of stock sizes. In use, the slide can be advanced as fast as the saw will take it without starting to labor.—Ken Sloan, Phoenix, Ariz.



7 Tips



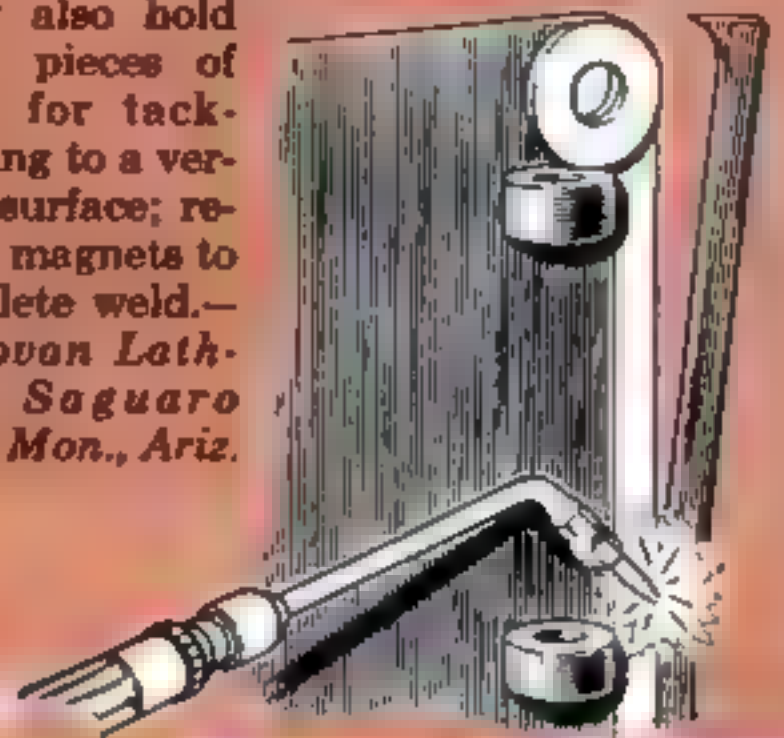
Lighten the gloomy view through the lens of your welding helmet. Nothing's more frustrating than trying to strike an arc precisely on a small piece of work in a badly lighted workshop. Keep a 150-watt spotlight (sold for studio or patio use) handy to direct on small indoor jobs.—*William G. Waggoner, Sacramento.*

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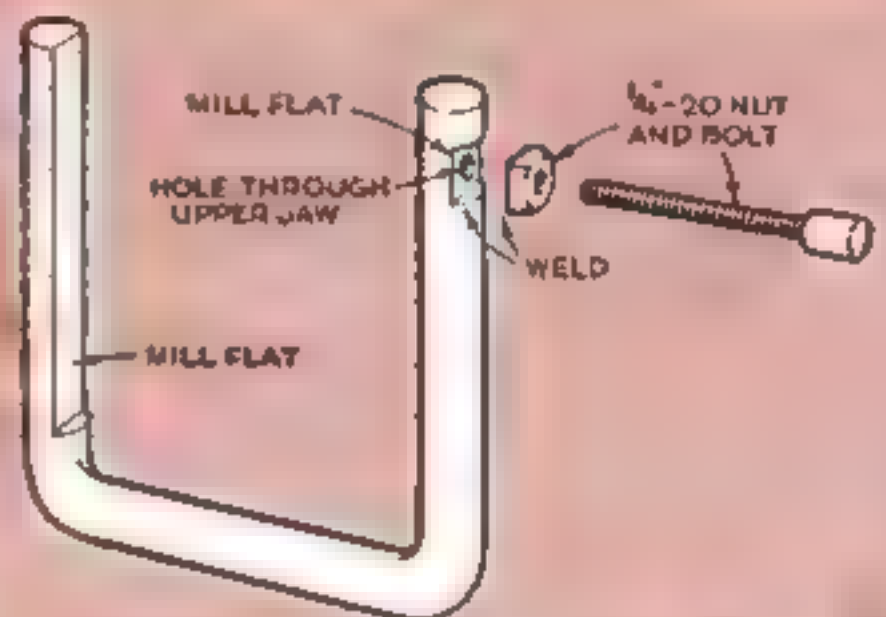
Magnets are welding clamps. Use them to hold metal templates on the face of the work when torch-cutting.

They also hold small pieces of steel for tack-welding to a vertical surface; remove magnets to complete weld.—

Donovan Lathrop, Saguaro Nat'l Mon., Ariz.

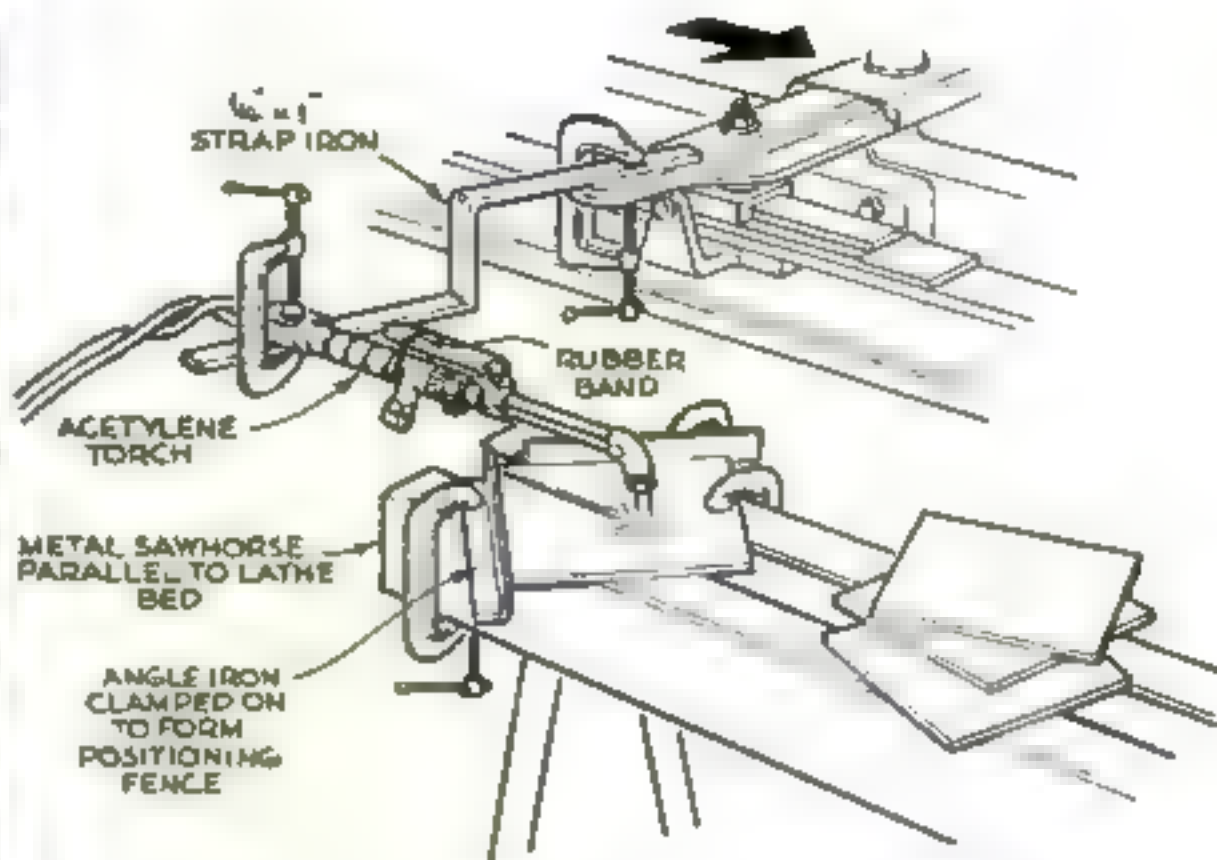
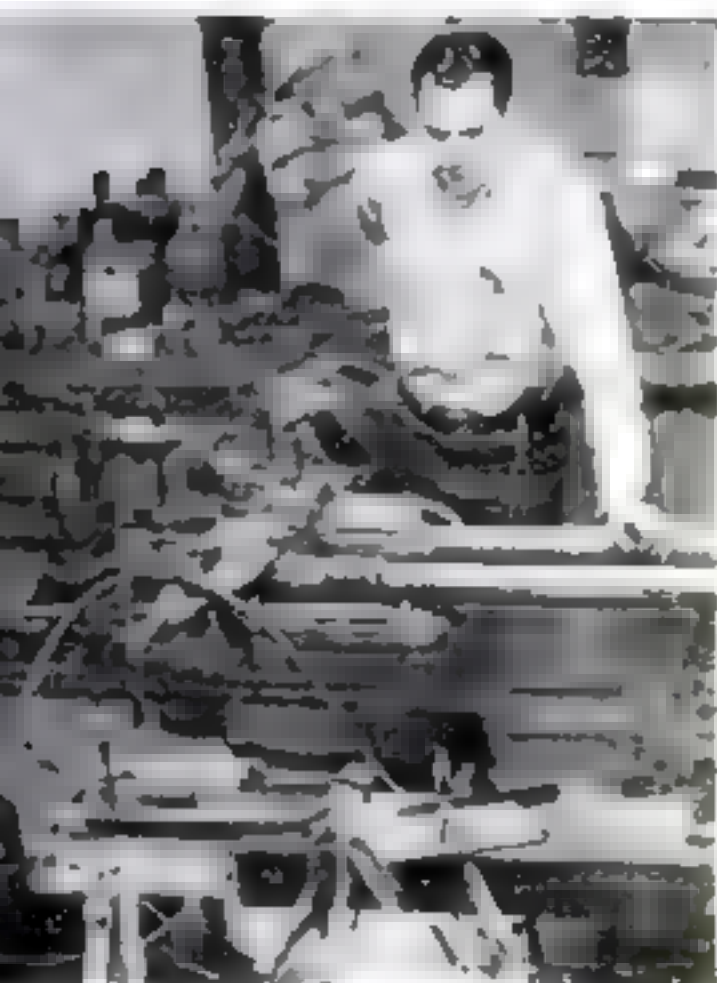


▶▶▶ **PLUG-IN** cables on arc welders often get snarled so that you must trace them out to find which end is the ground and which the rod holder. Solve this by painting the plug-in end a bright color.—*G. C. Busick, South Bend, Ind.*



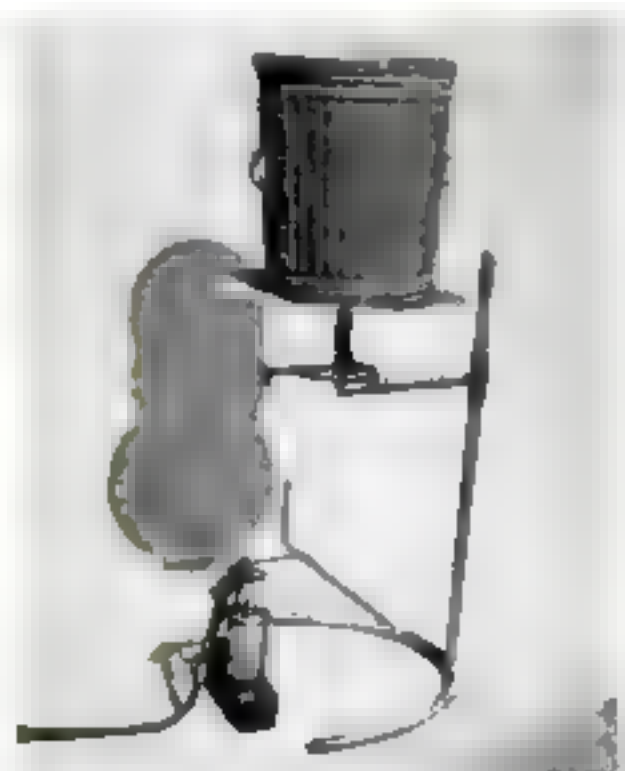
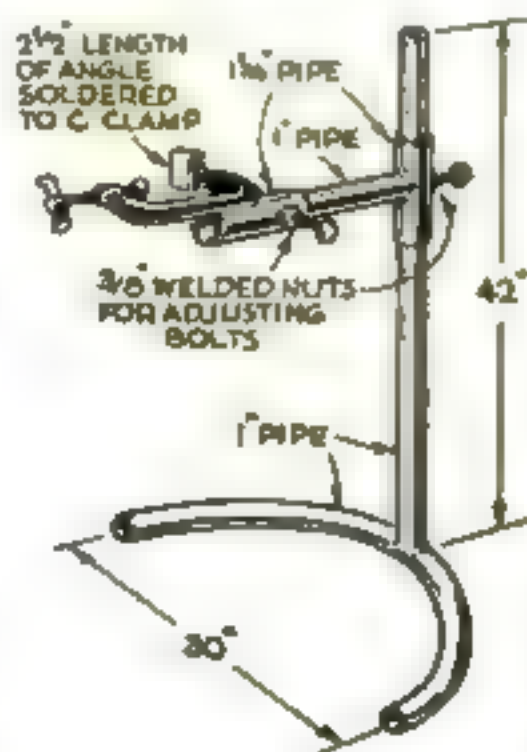
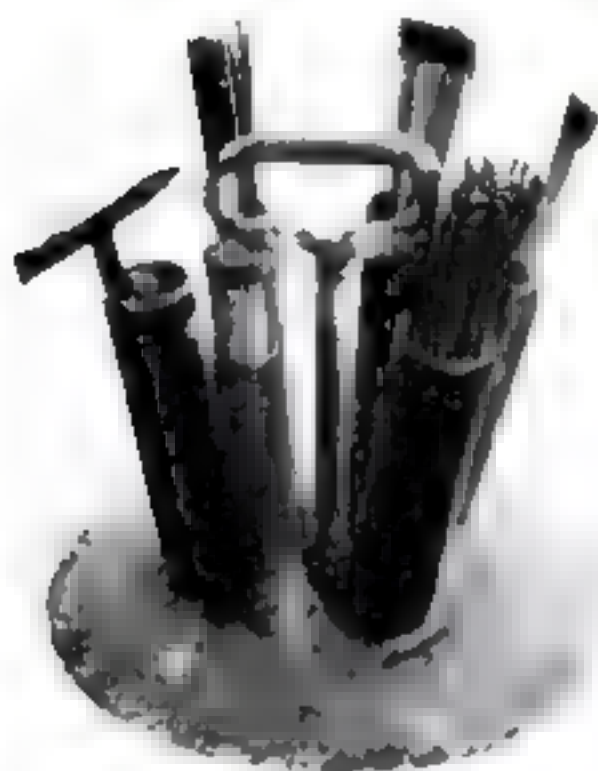
Clamps for light work can be made from salvaged auto-spring shackles. Mill the lower jaw flat and groove the upper jaw to seat the nut. Drill a clearance hole for the bolt, locating it within the groove so it will align with the hole in the nut when the nut is welded in place.—*Peter Legon, Malden, Mass.*

for Welders



Make straight-line cuts by bracketing an acetylene torch to a lathe carriage. Our shop had to make duplicate cuts across identical steel blanks. A hand-held torch wasn't precise enough, and we didn't have a cutting machine. Two bends

in a strap-iron bracket compensated for the height difference between the lathe and a sawhorse placed beside it to hold the work. We lit the torch, kept its trigger depressed, and engaged the lathe lead screw.—*Dean Merrill, Ripley, Okla.*

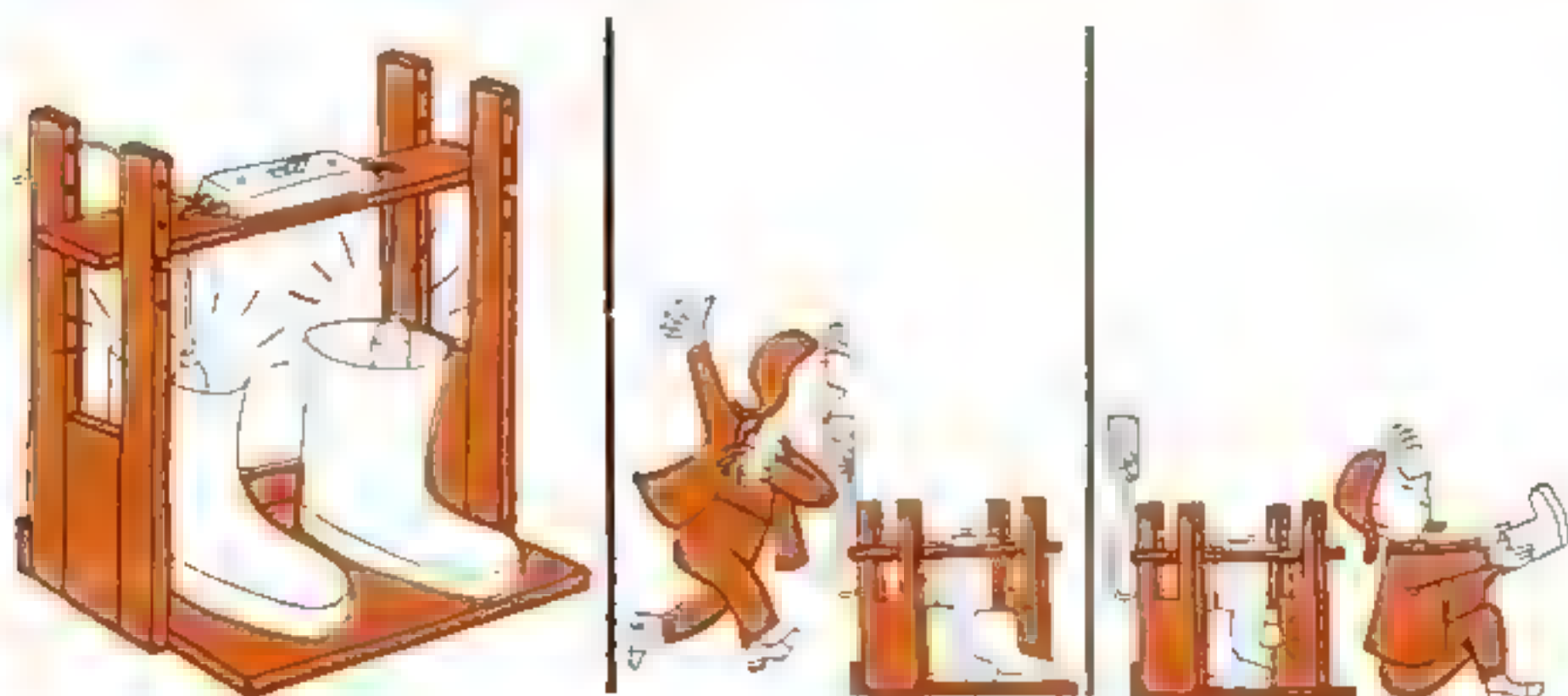
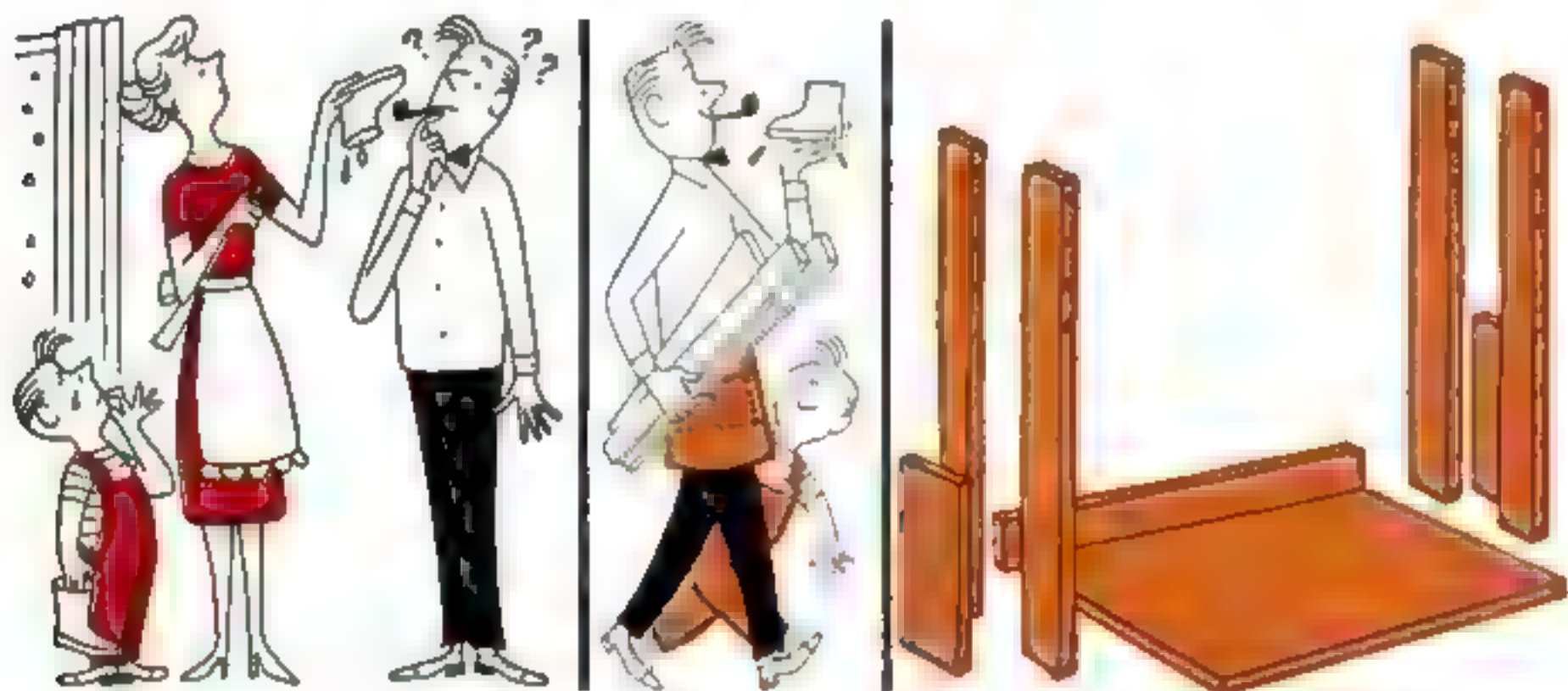


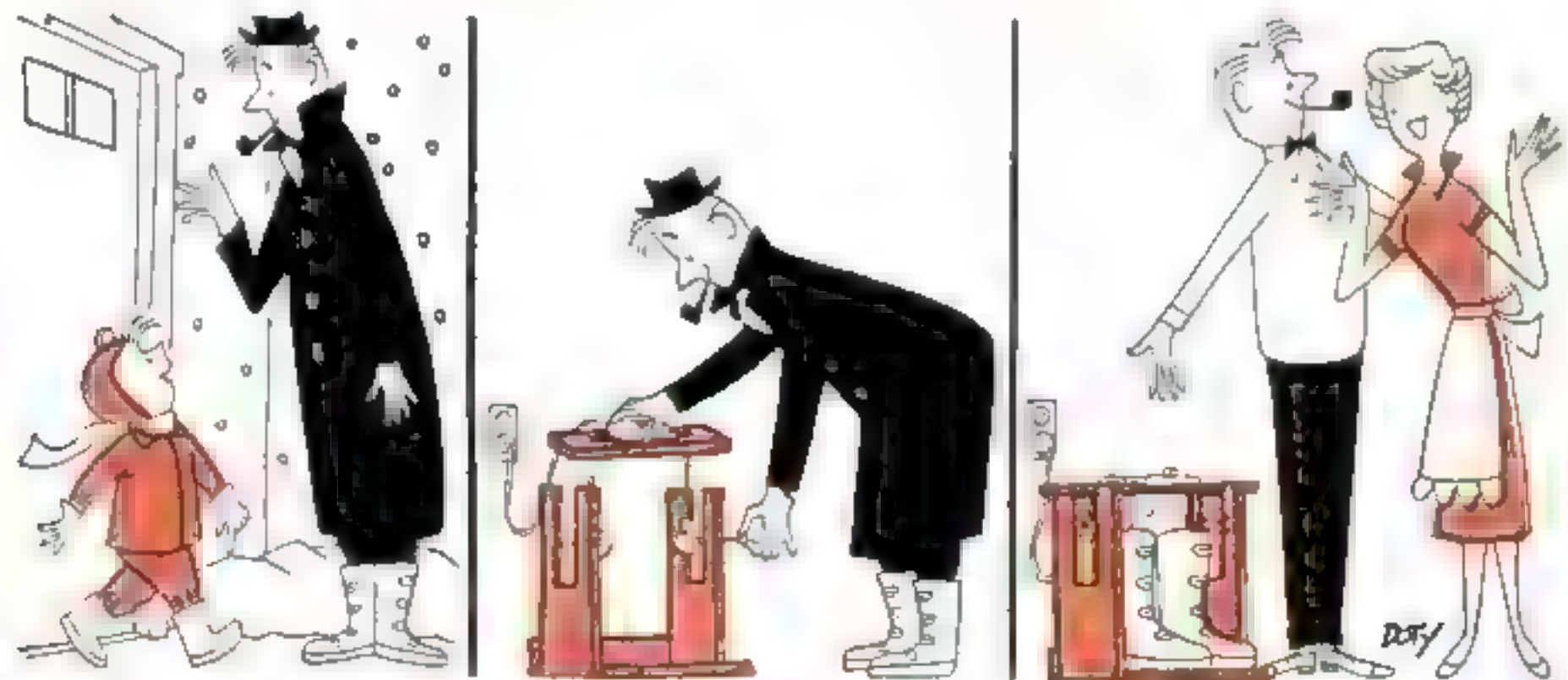
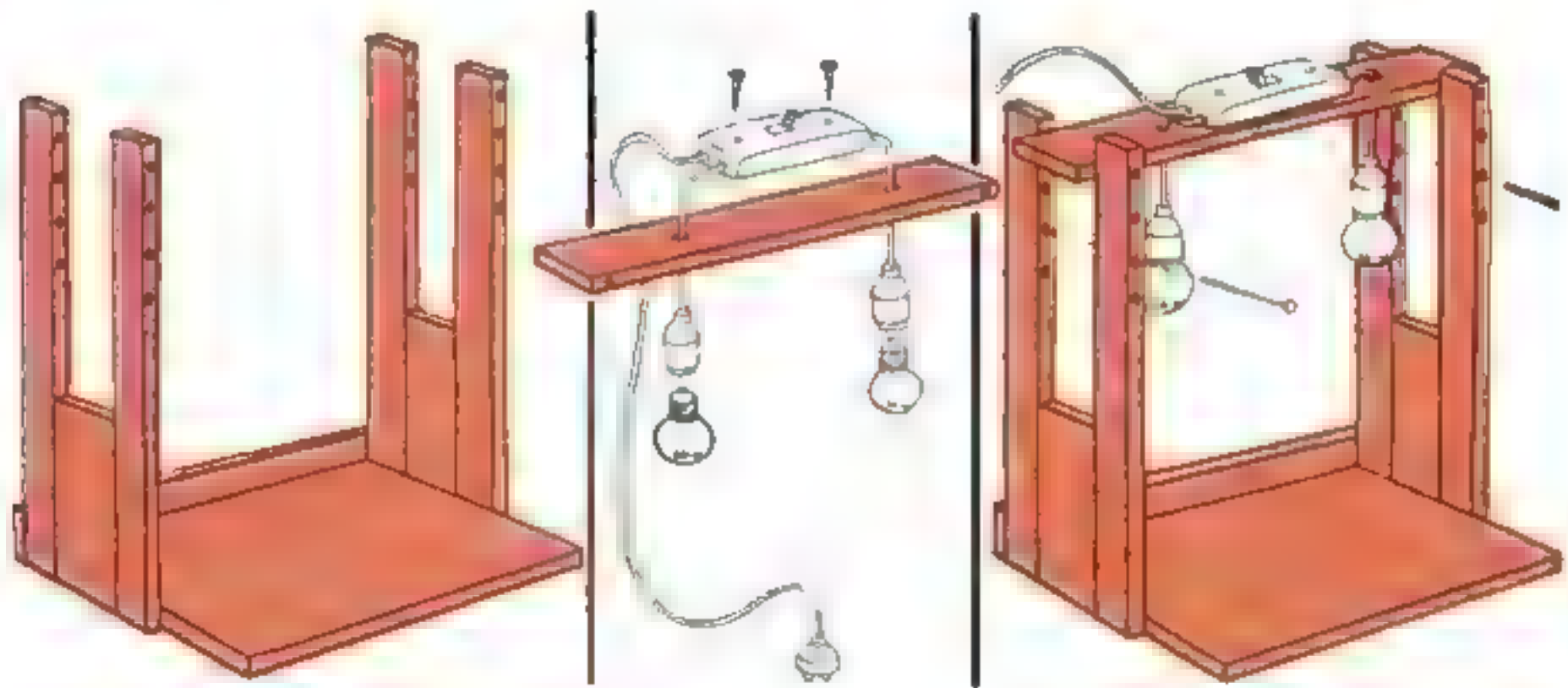
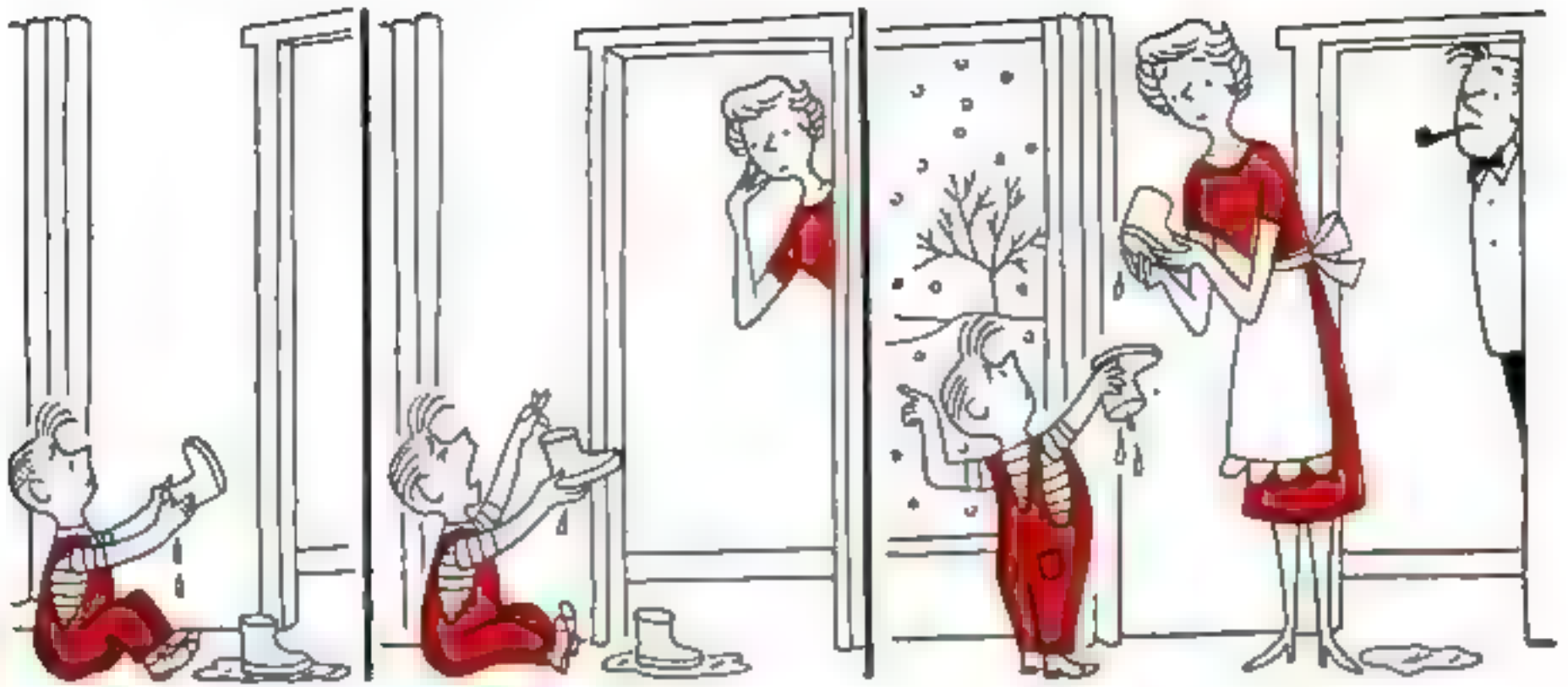
Tote rods to the job in this homemade carrier. It's an old disk-harrow blade with 8" lengths of pipe and a handle welded on. It stores five kinds of rod, and a chipping hammer.—*John Curoe, Bernard, Iowa.*

An adjustable clamp stand is handy for holding members in position while welding. C-clamp swivels and locks for vertical, horizontal, or angled support. With added accessory, stand converts into turntable, as shown in photo, above right. The platform is a steel barrel top with 1 1/4" pipe nipple welded at the center. This sleeve slips onto an 8" piece of 1" pipe clamped upright in stand.—*Donovan Lathrop, Saguaro Nat'l Monument, Ariz.*

Wordless Workshop

By Roy Doty
and Paul Corey





I Heat



BURNER AND BLOWER ASSEMBLY is bracketed to a converted bottled-gas cylinder, ready to be connected to a fuel line. Rheostat (below bracket) regulates blower motor. Rear of stove (right) needs damper if gas is burned instead of oil. Disk is $\frac{1}{8}$ " steel plate, 1" smaller in diameter than exhaust pipe; shaft is $\frac{1}{2}$ " steel rod. Platform welded on top of stove is optional.



By Bill Cheney

THE fuel I burn to heat my shop doesn't cost me a penny. In fact, I'm paid a buck for every 100 gallons I haul away. It's old crankcase oil, and gas stations are happy to have me pump it out of their waste tanks.

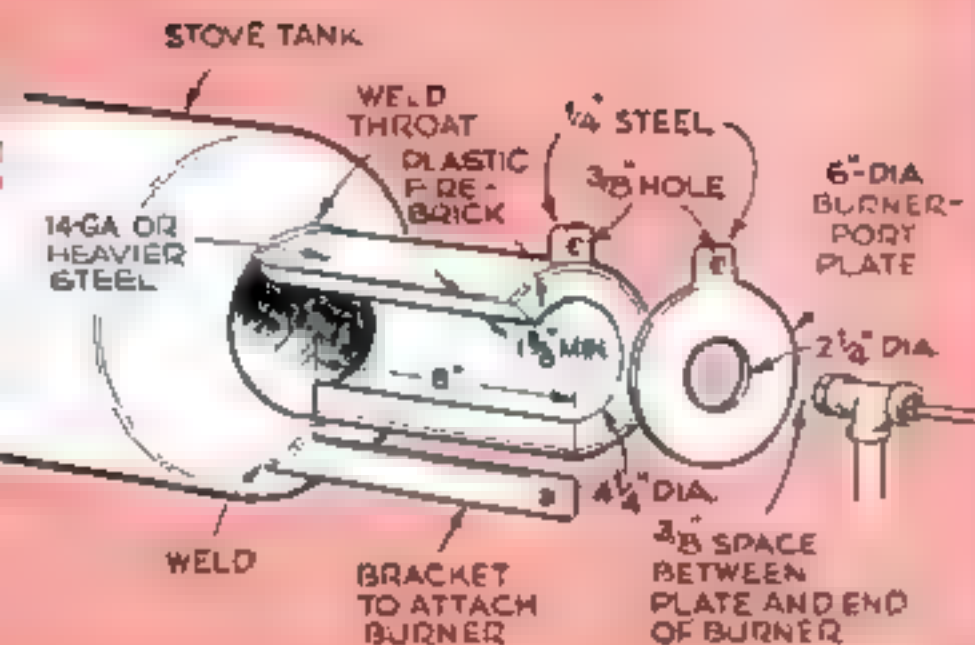
I built my own stove from a condemned bottled-gas cylinder. You can pick one up for peanuts because legally they can't be used again, and it's too costly to cut them up for scrap. If you can't get one, a 30-, 50-, or 100-gallon steel drum can be substituted. My stove cylinder is 14" by 40", but these dimensions aren't critical. The ones for the throat and firing port *are*, since they guarantee the hot throat that's required to burn any fuel. I circulate the heat with a small electric fan, and there's plenty

to spread around: With clean oil, the heater can produce up to 500,000 BTUs per hour.

It's clean heat, too, although some smoke is generated when the burner is first started. To carry this (and all carbon monoxide fumes) outside, a stack is required. Where erecting one is impractical, you can burn natural or bottled gas, instead. You just insert a different jet nozzle. When burning gas fuels, I exhaust right into the shop; there's some water vapor, but not enough to cause troublesome condensation. Better check local regulations, though. If they specify a stack for gas, too, you might as well enjoy the economy of crankcase oil.

Start with the stove. If you've been able to pick up an old bottled-gas cylinder, you must prepare it in a special way. Set the tank upright on its base and

My Shop with Crankcase Oil



fill it with water. Lay out an 8" circle at the crown of the domed top. Using a cutting torch, pierce the tank with a short arc cut on this circle. (As the cut will be below water line, water will flow out until level with it.) Complete the circle and drain the tank.

With the tank up-ended, cut a 6"-diameter hole in the center of the base for the exhaust. It's in the center so heated

air will build up in the top of the stove, improving combustion as well as retaining heat. I formed my exhaust pipe by bending a sheet of $\frac{1}{8}$ " steel plate, but lighter material can be used.

Weld the throat at the other end, and complete the stove by placing it on its side in a sturdy stand. Mine is a pipe frame welded to the cylinder and equipped with casters so the stove can be rolled around the shop or used outside.

You need lots of air to burn the fuel properly. I bought a used vacuum-cleaner blower and brazed a 1" pipe coupling into its outlet for attaching the burner pipe. Since throttling the air output causes the blower to speed up, an air-flow valve could damage the motor. Instead, I installed a rheostat, salvaged from a sewing machine, to regulate the motor speed.

The heart of the heater is the burner itself. It's made of four black-iron 1" pipe fittings. The deflector imparts a swirling motion to the blower air that helps mix it with the fuel from the jet. The jet is secured with a setscrew so it can be adjusted—or replaced with an-

My Most Embarrassing Shop Moment

John F. Bilek

North Hollywood, Calif.

I—AN AMATEUR—was smugly demonstrating to a group of carpenter pros how easy it is to toenail a stud if you brace it against your neck to keep it from slipping sideways. I poked my head between the studs, pulled the loose end toward me, and whacked it smartly in place.

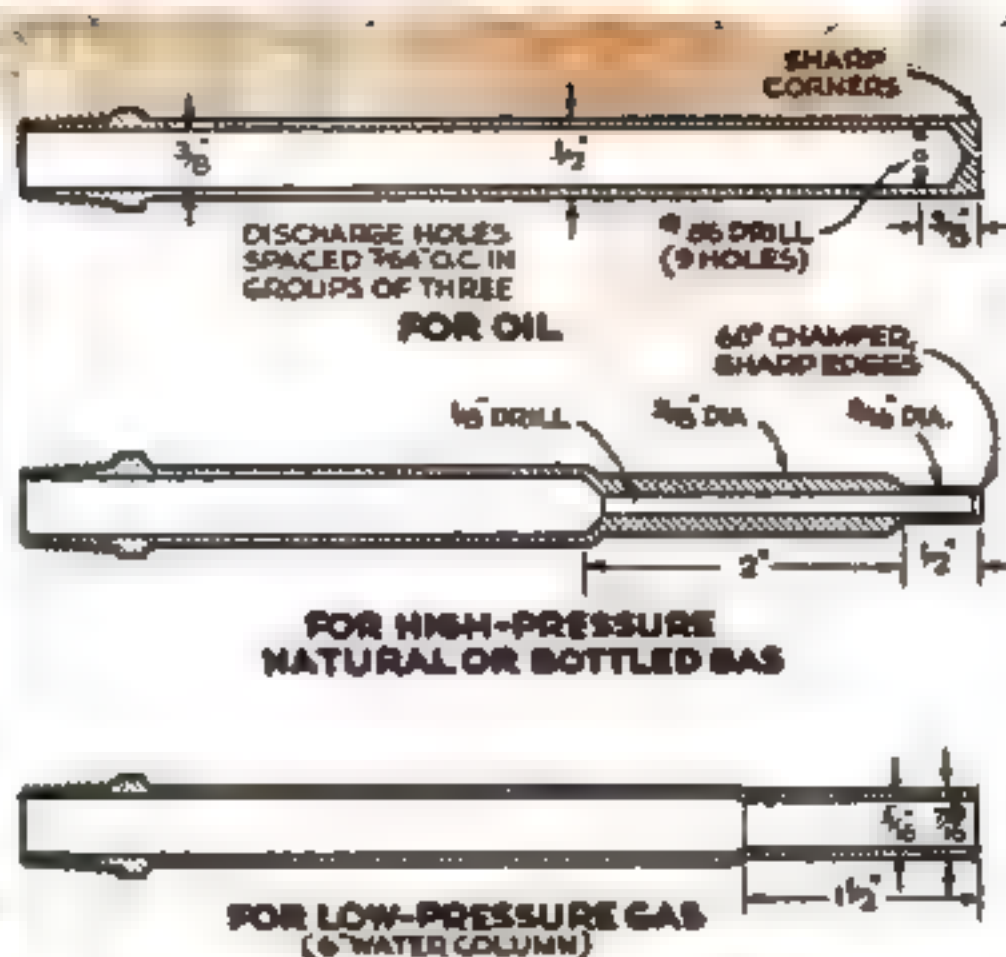
"There," I said proudly and started to step back. I hadn't noticed that this particular stud was right next to a door frame. I had trapped my head between them and was peering out foolishly like a caged monkey. It



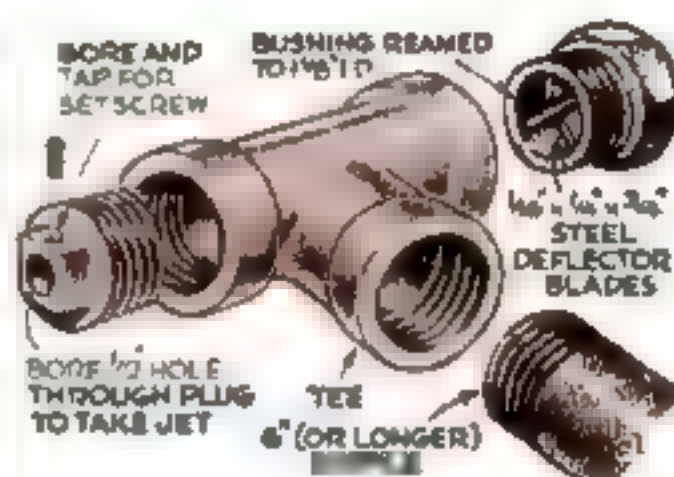
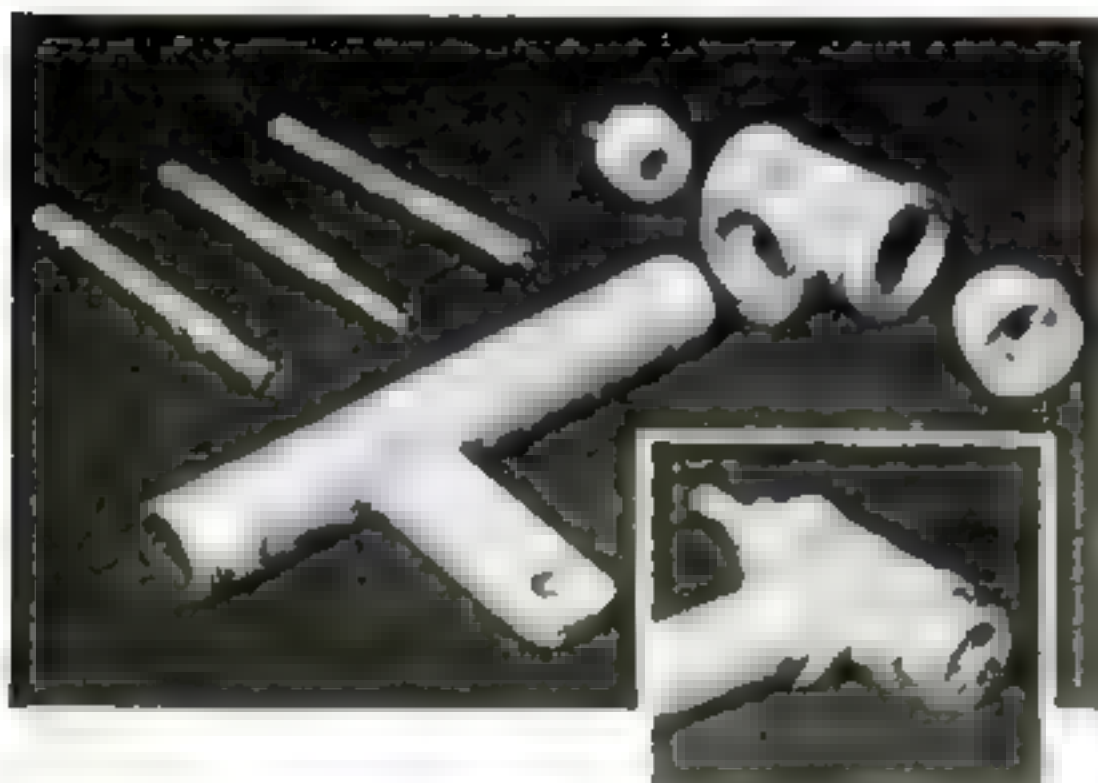
was quite a while before the gang could stop laughing long enough to set me free.



DRILLING DISCHARGE HOLES in closed end of oil jet is critical operation. Sharp edges are essential for clean burning. Be sure drill runs true at high speed; don't hold jet in fingers.



ALL JETS MACHINED FROM 6" LENGTHS OF 3/16"-DIA. BRASS ROD, WITH STANDARD 1/8" PIPE THREADS ON ONE END FOR SCREWING ON FUEL-REGULATING VALVE. THE MAIN SHANK OF EACH TAPER 1/2" OUTSIDE AND A 3/16" INSIDE DIAMETER.



THREE INTERCHANGEABLE JETS (for different fuels) slip through bored plug and deflector made from bushing, as in inset. Braze blades at 15-degree angle from axis.

other type if the fuel is changed. The position of the jet, in or out, depends on the choice of fuel, and—if it is gas—the fuel pressure. When oil is used, the bottom of the supply tank should be about a foot above the burner.

To start the burner, if oil is the fuel, open the port plate and thrust a crumpled newspaper or oil-soaked rag well into the throat. Light this, close the port, turn on a little air, and slowly open the fuel valve until oil ignites in the throat. Gradually increase the air supply; then give more oil. Once the throat becomes hot, increase the flow of both air and oil, experimenting for the best mixture and

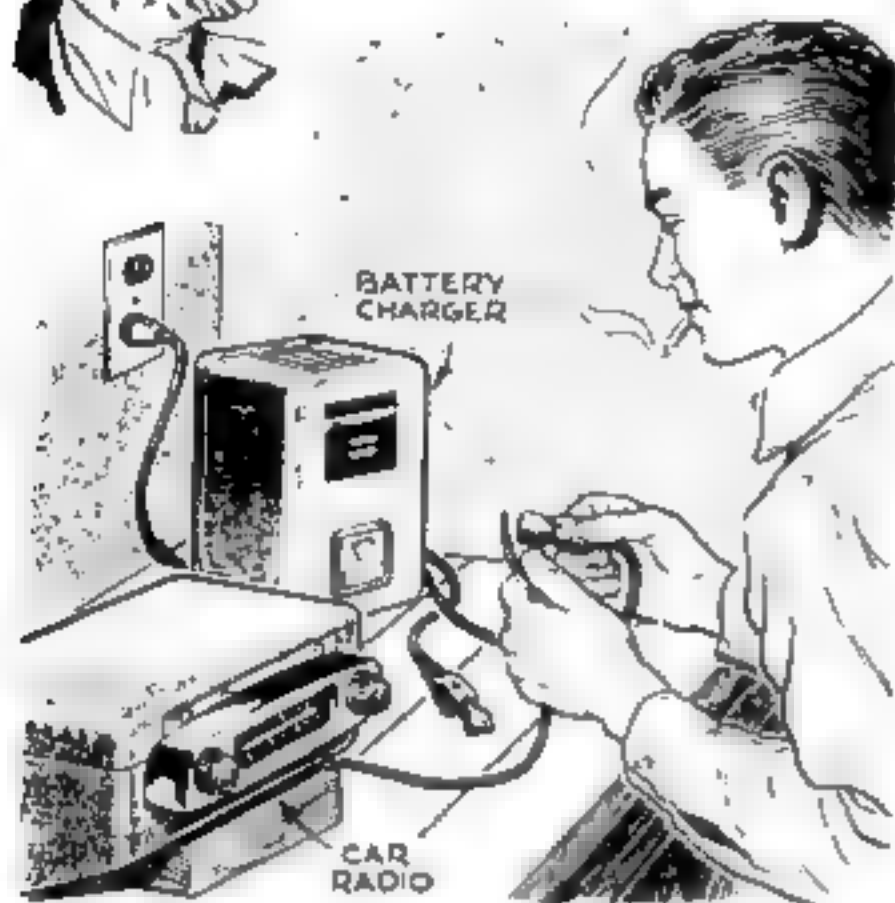
proper jet position. When properly set, there should be no smoke or soot. To shut the stove off, turn off the oil first, letting the blower run until the fire is completely out. If this isn't done, oil may drip onto the hot throat and flame will puff out of the burner port.

When firing with gas, start the blower at low speed and hold a piece of burning paper just below the closed port while slowly turning on the gas.

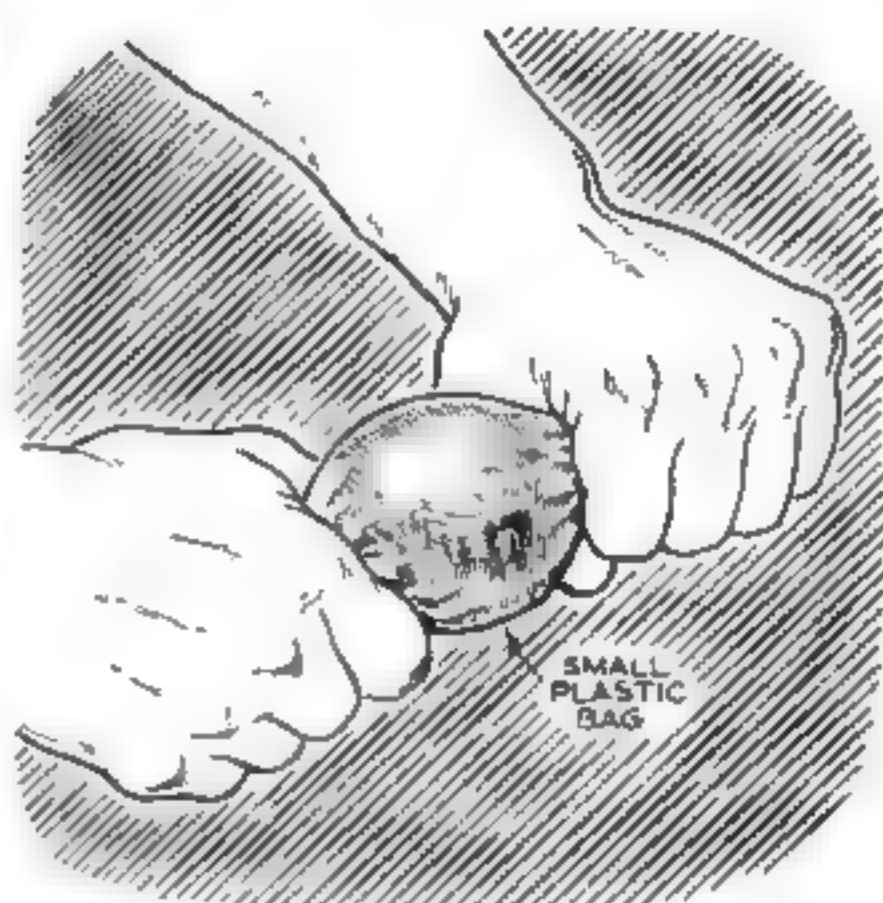
Whatever your fuel, never look directly into the port; always inspect it at an angle, or use a small mirror. While the fuel can't explode, the great heat might singe your whiskers. ■ ■



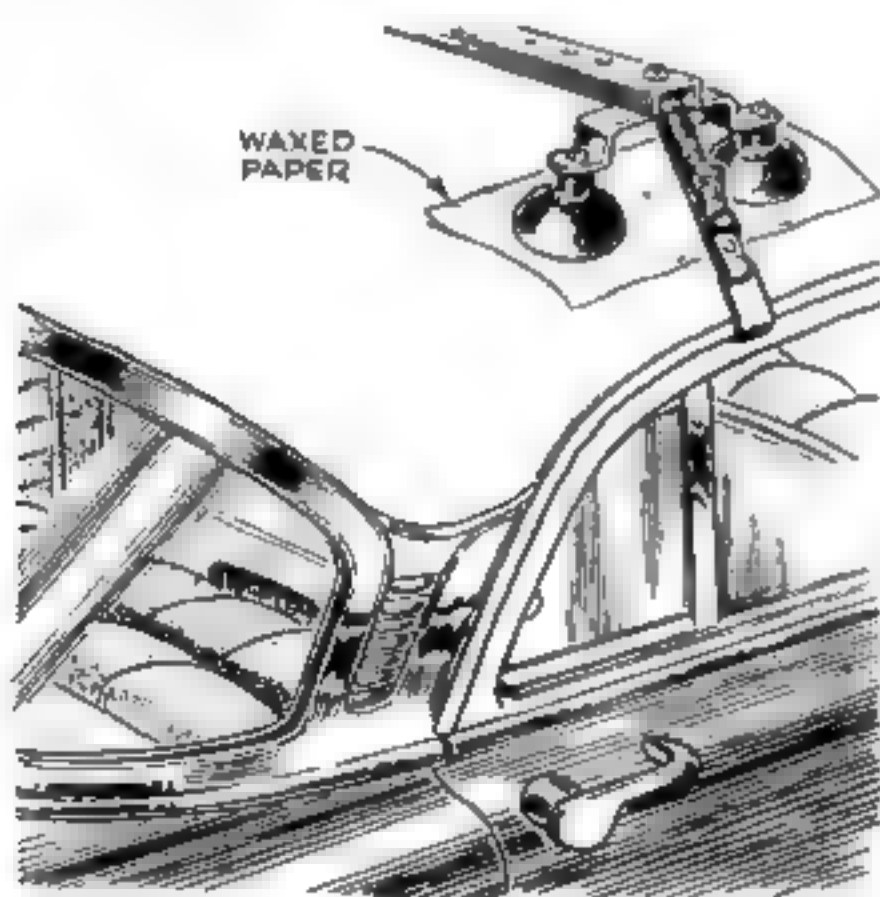
Hints from the Model Garage



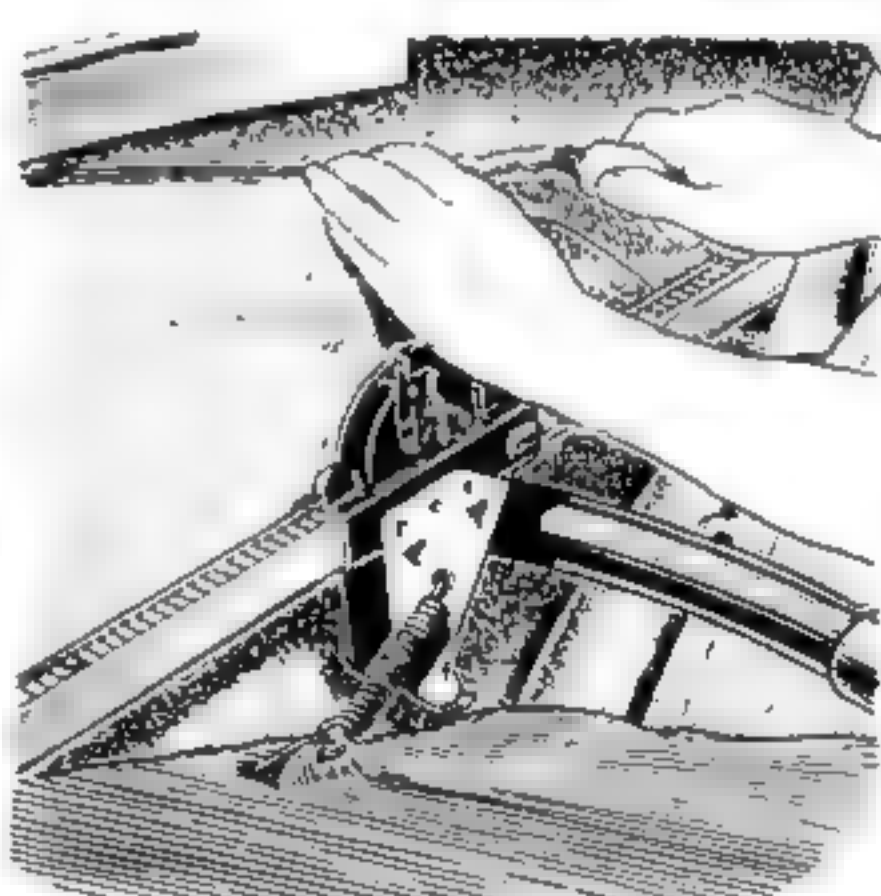
Trouble-shooting a radio or other electrical accessory from your car requires a low-voltage power source. A battery charger plugged into the house current acts as a converter. Just be sure its output is more than the accessory consumes.



Greasing a wheel bearing needn't be a messy or tedious job. Merely place the bearing and a generous supply of grease in a small plastic bag, grasp each end, and squeeze the grease around the bearing, manipulating with your fingers.



Roof marks left by rubber bases of car-top carriers are often hard to remove from light-colored cars. To avoid this chore after each short-distance haul, one motorist slips waxed paper under the cups before cinching the strap.

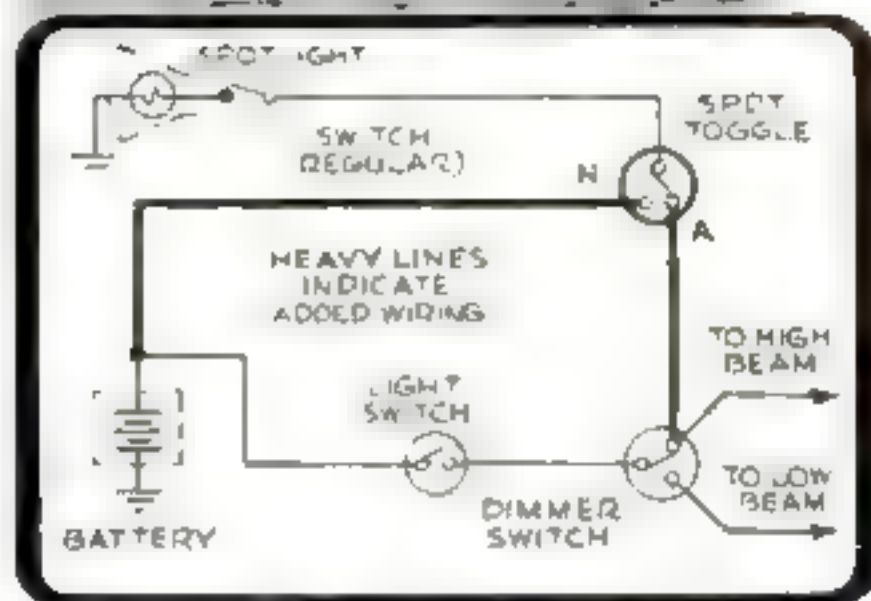


To anchor loose wiring under the hood and dashboard, or in the trunk, squeeze a bead of hard-setting sealant (such as Permatex Form-A-Gasket #1) along the wire's proper path and press the wire in place. It can be pulled loose any time.

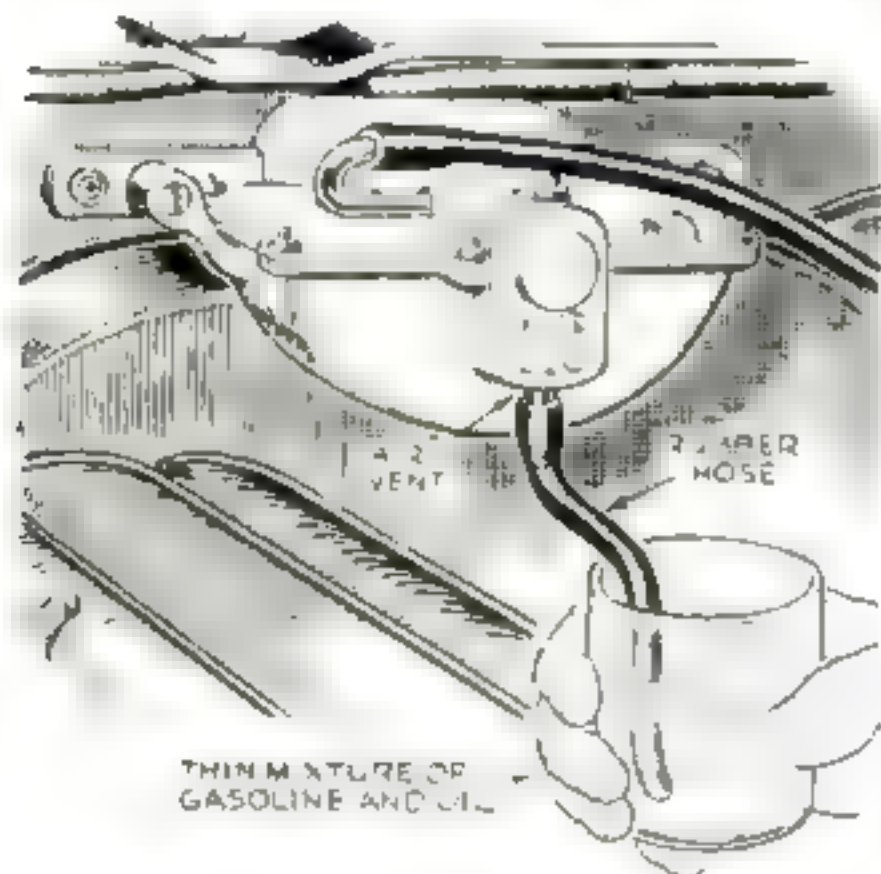
More Hints from the Model Garage



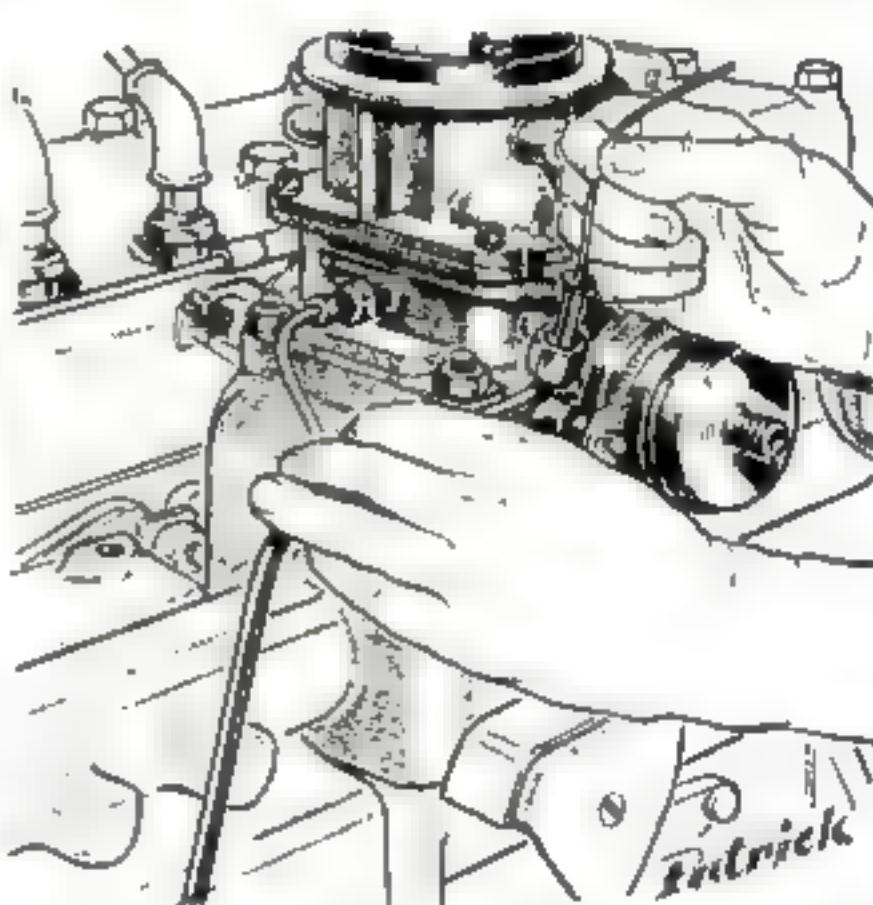
Nestle a trouble light next to the carburetor for quick starts on cold mornings. To keep the heat from dissipating too quickly to do any good, blanket the radiator and engine with a sheet of plastic film of the type used for storm windows.



Control a spotlight automatically by wiring a single-pole, double-throw toggle switch into the line. With toggle in A (automatic) position, the spot goes off when you change to low beam. For normal operation, flip toggle to N position.



A windshield-wiper motor can sometimes be serviced without disassembly. If the piston flap has dried out and doesn't seal, try lubricating it as shown. With wipers operating, the vacuum draws the gas-oil mixture into the dry chamber.



Trouble with an automatic choke? If the manifold tube is clogged, you may be able to clear it by alternately squirting in penetrating oil and inserting a steel wire an inch or two at a time. When oil drains out the bottom, reconnect the tube.

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Gus Gives the Doctor



a Checkup

By Martin Bunn

"Valves are running dry," said the young man glibly. "You keep driving—and I won't be responsible."



RAY QUINN

AS THE big sedan rolled to a stop inside the doors, the Model Garage owner rushed to it. "Back for a poker lesson, Doc? Or did they catch onto you in Florida?" asked Gus Wilson.

Doc Wilder emerged from the car. "Huh! I can pull the wool over their eyes just as long as you can keep folks thinking you know about cars."

The two appraised each other. "You're skinnier, but mean as ever," said Gus.

"Don't look too bad, yourself. But I didn't drive all this way just to see your homely face." The Adam's apple bounced on Wilder's throat. "Got fed up with that steam-laundry climate. Wanted to feel the zing of an honest winter again. So when old Betsy Hopkins yelled for me, and paid the freight—which she can afford—back I came."

"I heard the old lady was very sick," said Gus.

Wilder nodded. "She was my patient for 20 years, so she wanted me around. Why not? I'm retired, got no practice to tie me down. She's so much better I'm taking off for the weekend. Thought you might check the bus."

"Nice-looking car," said Gus.

"It has too many automatic doodads. A choke you can't work, power windows, overdrive, lights instead of gauges."

Gus grinned. "I know where you can trade it on a dandy Maxwell—"

He dodged Wilder's feint and got busy on the car.

Timing was right, the points in good shape, spark plugs fairly new. Gus cleaned them, checked the automatic choke, and replaced a carburetor jet.

Wilder, back from the diner, listened to Gus's report without enthusiasm. "Always has been a gas hog," he said. "Sixteen miles per gallon on the road. It's those durned gadgets—"

"You should get more now," Gus reassured him. "Don't forget to cut in your overdrive."

Doc snorted. "I'll use it, but it won't help. Say, Gus, I'm borrowing Ken Smith's cottage at Storm Lake. Why not come along for some ice fishing?"

"That streak you just saw," returned Gus, "was me going for my duffel."

CRISPLY clear, the weather was a joy to drive in. The big car ate up the miles, though at throughway speeds its motor revved so hard Gus was on the point of reminding Wilder to use the overdrive. But the doctor seemed as keyed-up as the engine. Several times he fiddled at the dash. Once, Gus noticed the radio aerial rise on his side of the car. Five minutes later, Wilder lowered it without having turned on the radio.

"Had this car long?" asked Gus.

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provide a cleaner engine



When you have your filter replaced, specify the best and most efficient—ROTUNDA. It has a one-way control valve to keep filter full of oil when engine is stopped, thus providing a ready supply of oil for instant lubrication on engine starts to reduce friction and undue wear. Helps prolong engine life.

The density of materials, rate of oil flow, and particle retention are precisely controlled to give the Rotunda Oil Filter double the useful life of many surface-type filters. The result is a cleaner engine, more satisfactory performance. Red arrows in illustration show precise path of oil flow through filter.

OIL FILTERS

and TWICE the filter life!

New depth-type Rotunda Oil Filters provide more efficient filtration for superior engine protection!

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Oil filters are but one of many high-quality Rotunda replacement parts now available through your Ford Dealer and selected service outlets.

Compare these quality features with any other filter you've ever used...

1 In the Rotunda depth-type filter, dirt is permanently trapped within a deep filter bed. The exacting Rotunda depth-type filter action traps particles as small as 39 millionths of an inch—finer than talcum powder. In paper surface-type filters, oil passes through only one surface . . . when that surface gets clogged, filtering action stops.

2 Filter materials used in Rotunda filters offer correct porosity to assure proper oil flow with maximum filtering protection for the engine. In some high-density, stuffing-type filters, the filtering materials are so tightly compacted that they block the oil flow and force the oil directly back through the relief valve.

3 The Rotunda filter has a spring-loaded, positive-action relief valve that is located at the oil entrance end of the filter. If the filter ever becomes plugged because of extended usage, the relief valve will open to provide a full supply of oil to the engine for proper lubrication.

Over-all design, construction and workmanship of the Rotunda Oil Filter is another reflection of traditional Ford high quality control.



And...when you order Rotunda Oil Filters, ask for Rotunda Shock Absorbers, too!

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SERVICE OUTLETS...**



QUALITY PARTS FOR CARS AND TRUCKS

PRODUCTS OF  MOTOR COMPANY

"Three years. It was a year old when I got it, loaded with useless gadgets like that overdrive, but a good buy."

A suspicion gnawed at Gus.

"Use the radio much?"

"What for? Nothing on it but rock and roll, commercials, and world crises," Wilder said wryly as he turned in at a restaurant.

"Betsy's doing fine," he said, coming back to the table from the phone booth. "Any real emergency, that young fellow who's been doctoring her could handle better'n I could."

As they left the restaurant, Gus casually asked if he might drive. Wilder agreed. Getting behind the wheel, Gus noted that the overdrive control was locked out.

He pushed it in. The car slipped into overdrive the moment Gus released the throttle. It skimmed along now with the engine merely humming.

"You sure got the touch, Gus. She never felt this smooth to me before."

"Nothing wrong with the overdrive in this car," Gus assured him.

"Oh, I know that," was the astonishing reply. "Had it checked three times because I couldn't feel the difference with it in or out. But it sure feels different when you drive."

Only when they left the throughway and headed into mountainous country did Gus lock out the overdrive again.

IT WAS Sunday afternoon when they left the cottage, Wilder driving. On the crest of a ridge, he suddenly braked to a stop and pointed. "Doggone oil-pressure light's on!"

"Better shut off the engine, Doc."

Wilder did so, then turned to Gus. "On this trip you're my guest. We'll coast down and find us a mechanic."

This seemed unlikely to Gus, on a Sunday. The car gathered speed on a long downgrade, Doc skillfully braking to hold it to a safe limit. A gas station came into sight. He triumphantly rolled alongside the pump.

A woman, bundled against the cold, shook her head when Wilder asked for a mechanic.

"My husband's away for the day. A phone? Sure. In there."

Wilder scurried off. While the woman put in gas, Gus checked the oil. It was up to level. The connection at the oil-pressure sender on the engine was tight. From his tackle box Gus took one of the wrenches he always carried on car trips and removed a valve cover, taking care not to damage the gasket.

"I couldn't get through," called Wilder as he came out. "Cold snapped some phone wires. What're you doing?"

"Just checking," said Gus. "Start the engine and let it idle a moment."

As Wilder did, oil promptly gushed into the valve chamber at ample pressure. Gus replaced the cover.

"Oil's pumping," he told Wilder. "Trouble's in the indicator circuit."

They went on, Wilder driving fast, the red light aglow all the way. Near the throughway, he turned into a station showing a "Mechanic on Duty" sign.

"Can't stand that danged light any longer," he muttered. "And I want to try the phone again. Don't go to work now, Gus. I'll get a man to tend to it."

A lean young mechanic came out, checked the oil and sender terminal, and

The Problem of the Rescued Robin



WORKMEN at a construction job saw a young robin fall from its nest into a 30"-deep hole in the masonry. As the opening was only 1½" by 4" in cross section, they were at a loss to free the bird.

A 10-year-old boy offered to try. Working alone without tools, sticks or even a piece of string, he got the fledgling out of its concrete prison in one hour, none the worse for its experience. How?

Hint: Only a living thing could be raised with the method used.

ANSWER: This really happened. The hero of the occasion was Danny Sippy of Meadville, Pa. He dribbled sand into the hole a little at a time. The outraged robin repeated-ly shrugged it off and climbed atop the accumulating sand, until it was high enough for Danny to reach the bird and lift it out.

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peered under the dash, eyes squinting.

"The phone's still out," reported Wilder. "How about that oil warning?"

"Valves are running dry," said the young man glibly. "You keep driving this car, mister, and I won't be responsible. We can run you over to a motel and have the car fixed by tomorrow noon."

Dismayed, Wilder turned to Gus, who shook his head.

"I shouldn't have left Betsy," the doctor said. "You drive, Gus."

Sliding into the driver's seat, Gus again engaged the overdrive. Soon they were clipping off throughway miles, the

turned. "Betsy's in the hospital, I've got to get back. Let's go."

"In this car?" asked the frowning mechanic. "With a clogged oil pump?"

"How fast can you fix it?"

"Six, seven hours. If you drive on, it's at your own risk."

"We'll risk it," said Gus.

Again he took the wheel. At throughway speeds, the big engine poured heat around Gus's legs. He snapped open the cowl ventilator on his side for a few moments of cool air. He was about to close it again when he saw that the oil-pressure light was out.

He closed the vent. The light came on. Satisfied, Gus concentrated on closing the miles to the hospital.

"BETSY pulled out of it as soon as she saw my face," Wilder told Gus next day. "She's getting better. Now, what'd you do to my car? The idiot light's behaving, and the car drives like silk over 30."

"The idiot," said Gus, "was an assembly worker who looped the indicator wire—it must have been too long—around the vent lever. When it wore through, it grounded the circuit and lit

the bulb, same way the sender unit would. All I did was tape the wire."

"So that's it. And the other thing?"

"Even easier. Lock out your overdrive, Doc—and watch the radio aerial."

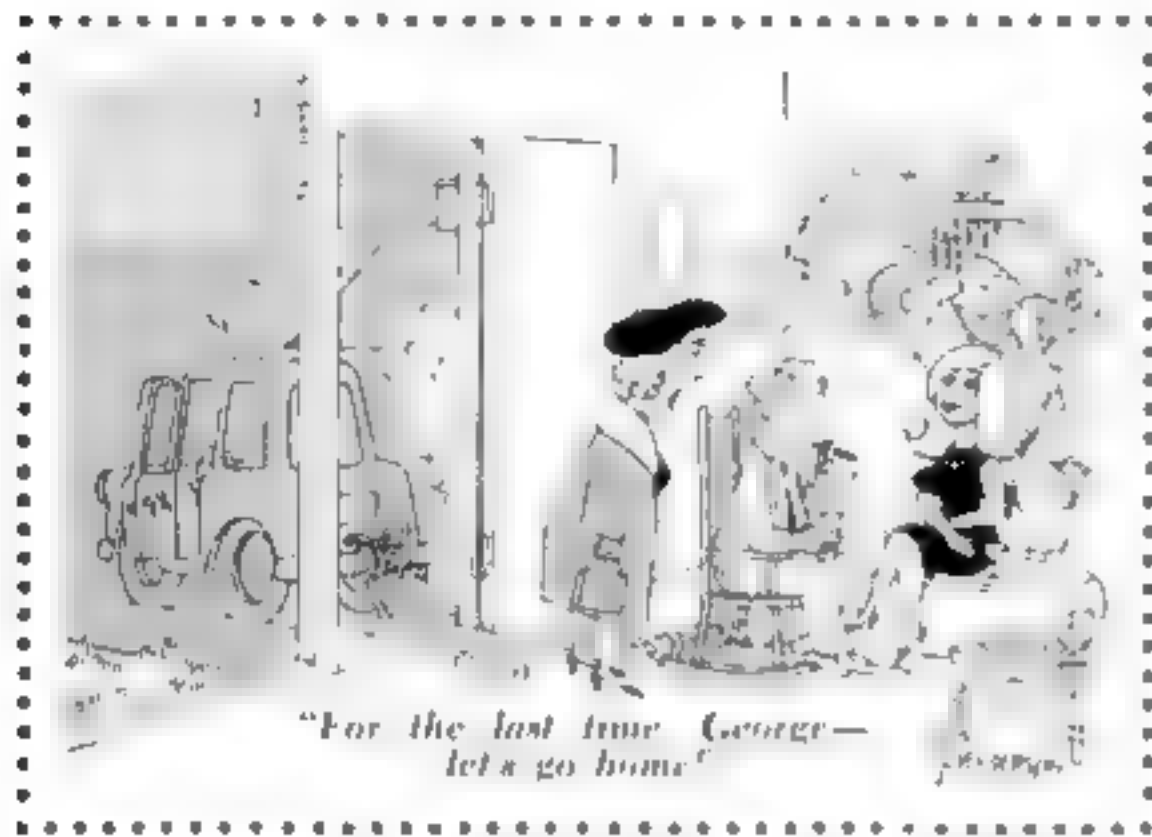
Puzzled, Wilder pulled the same knob he'd reached for on the trip—and in amazement watched the antenna slide up. He punched the button in. The antenna sank. A slow grin overspread his face.

"For three years I've cranked that fool thing up and down, and thought I was locking the overdrive in and out. No wonder I didn't feel any difference."

"Pretty fancy car," said Gus. "Even the aerial's powered. It could happen to anybody not used to overdrive. Think of the gas mileage you'll get now."

"I'm thinking how come a fool thing like this had me buffaloed so long."

Gus grinned. "Only one reason," he said, pointing to the overdrive control. "This part wasn't automatic." ■ ■



red warning signal still glaring at them.

"Never did like these idiot lights," grumbled Doc. "Gauges are way better."

"They cost more," Gus pointed out. "Besides, Detroit says drivers might miss a low gauge reading, but can't help notice when a red light flashes on. Sure, a light won't show that oil pressure is falling—it waits till it's under 10 pounds or so. And the charge indicator won't squawk so long as the generator's putting out, even if most of the juice is drained off by lights and other accessories. But I guess idiot lights are here to stay."

"I still don't like them," muttered Wilder. "Stop at this station, will you? I'll try the phone again."

He was out and talking to a mechanic before Gus could stop him. The mechanic put his head under the dash, started and shut off the engine, and peered furtively under the hood.

Wilder was visibly upset when he re-

HOME SHOP

news report

By Sheldon M. Gallager

Here they come: self-powered tools. In the brief time since Black & Decker introduced its battery-powered drill, no less than eight newcomers have been added to the tools you can run without being tied to a power cord. Two—a portable circular saw and a $\frac{1}{2}$ " drill—are driven by tiny gas engines. The other six are battery-powered tools, shown below, that Skil Corp. plans to introduce this year. The B & D drill has built-in batteries. In contrast, the new Skil tools will get their power from a separate battery pack clipped to your belt.



What you can do with B & D's drill. Put through its paces by PS editors, the new cordless did a surprising number of rugged jobs, including a few that not even its own maker claims for it. Fitted with a screwdriving attachment, it easily sank 2" No. 10 screws in pine in about 13 seconds—only 3 seconds slower than its cord-powered cousin. It also did fine on light disk sanding and even powered an accessory hedge trimmer—jobs it really isn't intended to do.



In drilling, the tool's limited power isn't noticed until you go up in hole size and hardness of material. With a $\frac{1}{4}$ " bit, it will pierce $\frac{3}{4}$ " pine in 2 seconds, $\frac{3}{4}$ " plywood in $2\frac{1}{2}$, and $\frac{5}{8}$ " maple in 6—about as fast as any drill. With larger bits, the gap widens. A 1" hole in $\frac{3}{4}$ " pine took a full minute, compared with 10 seconds for a regular drill.

Steel and masonry are no problem either—if you keep the holes small. With a $\frac{1}{4}$ " masonry bit, the drill

easily chewed through the side of a concrete block in 54 seconds, but bogged down with a $\frac{1}{2}$ " bit, requiring 5 minutes. In $\frac{1}{8}$ " steel, it drove $\frac{1}{4}$ " holes in 20 seconds—only 4 seconds behind a regular drill. All tests were made with sharp, new bits—the secret of conserving power. With dull bits, the tool took four to five times as long in wood and had difficulty penetrating $\frac{1}{8}$ " steel at all.

Chief drawback of the cordless drill is that, despite its magical name, it doesn't really free you from a power cord for very long. There's the matter of keeping it charged, and this takes house current. Under hard use, battery life is short—as little as an hour.

This is a nuisance if you're in the middle of an important job. Under light, intermittent duty, however, there's enough juice to get you through a weekend nicely. By actual test, the tool bored 174 holes of $\frac{1}{4}$ " in $\frac{3}{4}$ " pine on a single charge without stopping; it will do better if rested periodically.

Recharging takes a minimum of five hours on the charger's fast setting and overnight on trickle. The quicky charge did not prove too practical—five hours is a long wait on most jobs. Two minor complaints are a missing trigger lock—left off to discourage battery drain—and a slightly fatter-than-normal pistol grip, made necessary by the batteries housed inside.

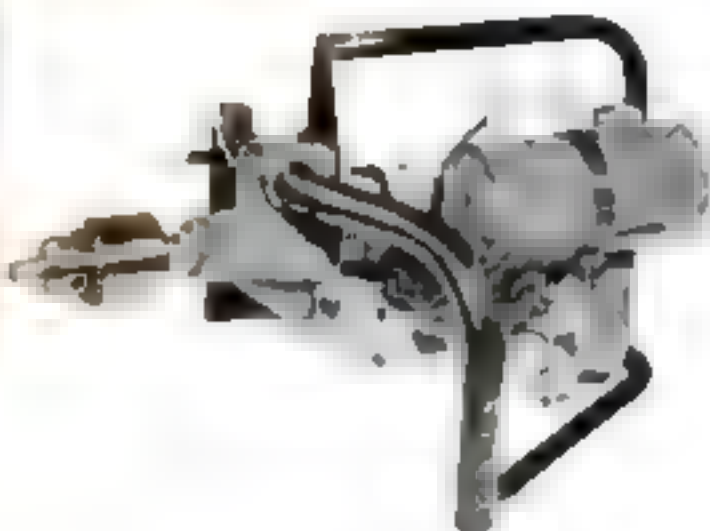
On the plus side, you'll welcome the tool's quiet, almost vibrationless operation—a far cry from the high-pitched clatter of conventional drills. Also, despite its built-in batteries, it weighs only four pounds—no more than most $\frac{1}{4}$ -inchers. The luxury of portable power doesn't come cheap. Cost: about \$50 for the drill and \$10 for the charger.

And now: gas-powered portables. The unusual-looking portable saw and drill shown

above have one important thing in common: Both are driven by the same gasoline engine, the powerful little $\frac{3}{4}$ -horse Ohlsson & Rice one-lunger described in PS last June. The saw, swinging a big 8" blade, weighs only 9 pounds and the drill, with $\frac{1}{2}$ " chuck capacity, only 11—no more than their electric-powered equivalents.

The tiny two-cycle O & R engine has a diaphragm-type carburetor so you can operate both tools in any position, even upside down. Both will run all day on a gallon of gasoline. Like the B & D drill, both were also given personal tryouts by PS editors. The saw, called the C/Saw, is made by Comet Manufacturing Div., 875 Arroyo Pkwy., Pasadena, Calif. It will be priced at about \$120. The drill will go for about \$90 from Savidge Specialties, 529 Venezia Ave., Venice, Calif.

Putting the gas saw to the test. The 8" blade cuts up to 2 $\frac{5}{8}$ " deep at 90 degrees and 1 $\frac{7}{8}$ " at 45. In trials, it sliced through two-by-fours in less than two seconds, two-by-eights in about four. In $\frac{3}{4}$ " plywood, you can zip along at the rate of a foot in 6



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Home shop news report continued

seconds, 10 feet a minute—about twice as fast as the average 6½" electric saw. There's so much power to spare that you find yourself forgetting to worry about kickbacks or binding. Every effort was made to jam the blade intentionally—but it just wouldn't. Under really abusive use, the worst you can do is stall it.

Firing up for the first time is a brand-new experience. The blade is off and spinning the second you start pulling the cord—something you have to be careful to remember. Getting a good grip on the saw during cold starts was found to be a bit tricky since the handle is located at the extreme rear and tends to let the front bounce up as you pull the cord. You keep wanting to put your fingers where no fingers should be. Extending the handle farther forward would solve this and also improve the saw's slightly nose-heavy feel. (Newer models, it is understood, will have an added front handle to let you use two hands.)

Once warm, however, the little O & R engine kicks off so willingly—surprising, because two-cycles are usually cantankerous—that you can easily hold the saw with one hand and pull the cord with the other. Blade speed is about 3,500 r.p.m. under load. For quick shutoffs, there's a handy short-out button on top of the handle. This was a bit too handy at times, as it's right where you occasionally want to put your thumb for leverage.

The gas drill: more than just a drill. You're in for a surprise when you remove the chuck from this powerful drill. Fitted with a pulley, the engine becomes a portable power plant for belt-driving accessory equipment such as a small generator for electric power, pumps and blowers, or a compressor for spray painting or even a diving rig.

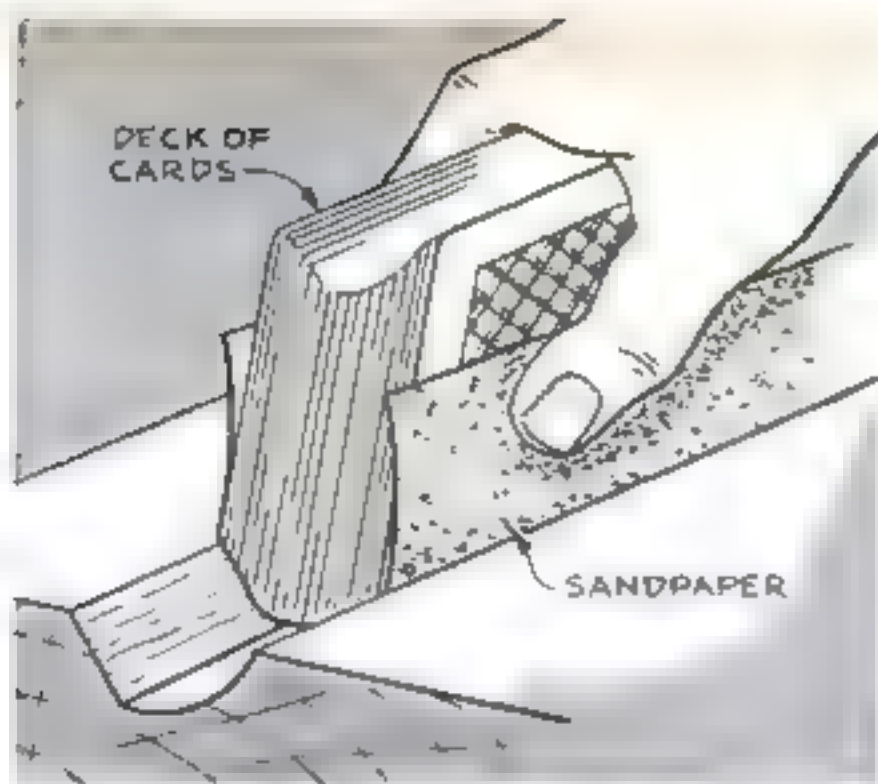
The tool has a lovable Disneylike oddball appearance, but don't let it fool you. It's actually maneuvered easily—except in very tight spots—by an ingenious wraparound tubular handle that encloses the entire engine. This gives you a sturdy two-hand grip, like a car's steering wheel. When the going gets rough, you can heave your full weight against the back of the frame, and this transmits force directly to the bit without straining the engine crankshaft. The frame also serves as a bench stand when the engine is used as a separate power plant.

In drilling, the tool chomped ½" holes in four-by-fours in four seconds and gaping one-inchers in about six. It also bored ½" holes in ½" steel and through a concrete block—both in about six seconds.

One of the delightful bonuses you get with a gas engine is a throttle control. By adjusting engine revs, you can vary drill speed to suit different materials, such as steel or concrete. A built-in centrifugal clutch enables you to throttle way down without stalling—the clutch simply lets go and the engine continues to idle. This gives you a speed range from about 300 r.p.m. up to 900 r.p.m. wide open.

Only complaint here is that the spring-loaded throttle works backwards to what you'd normally expect—you push it to slow

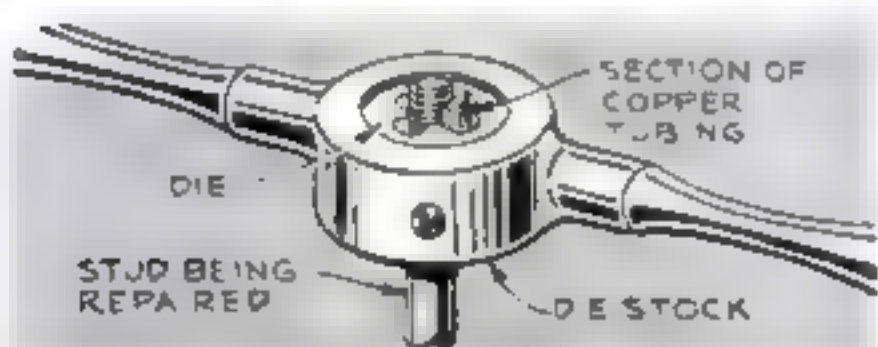
[Continued on page 214]



Card Deck Is Sanding Block

TO SAND along grooves or shaped moldings, fold the paper around an old deck of cards. The deck will conform to the contours of the wood, assuring a more even contact than you'd get with your fingertips.—*Daniel Bousha, Jackson, Mich.*

▶▶▶I HAD to remove a large number of roundhead screws. Since all the heads were $\frac{1}{4}$ " in diameter, I cut a piece of $\frac{1}{4}$ " copper tubing a little longer than the blade and shaft of my screwdriver and slipped it on to seat against the handle. Fitted over the head of a screw, this sleeve guides the driver blade into the slot and keeps it from slipping out. It speeds the work, especially when you learn to use it with one hand.—*Stephen N. Stresnic, Fort Lauderdale, Fla.*



Copper Shim for Oversize Die

THE bruised and rusty threads on a stud had to be repaired, but I had no die of the proper size. My solution: a die of the same pitch but of larger size. When starting it on the stud, I displaced it to one side and wedged a section of copper tubing into the gap. As the die threaded itself on the stud, the soft tubing absorbed all the play and let the cutting edge clean out the threads.—*Joseph F. Sadlow, North Reading, Mass.*

Short Cuts and Tips

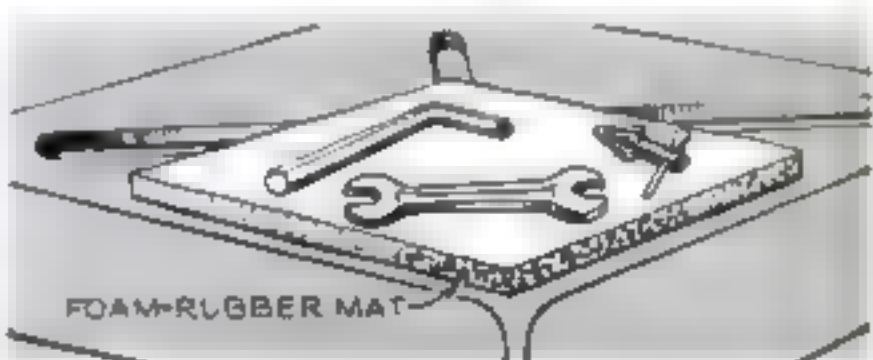
FROM PS READERS



Bugproof Lamp Bowl

LIGHT-CRAZED insects are a nuisance when they commit suicide in the reflector bowl of your floor lamps. To avoid frequent cleaning, lay a disk of window screen across the top. The shade holds it on.—*Wayne Floyd, Fayetteville, Tenn.*

▶▶▶You can lathe-turn simple cylinders of wood using toothed forming tools (such as the Stanley Surform file or plane) instead of the usual turning chisels. The toolrest is raised nearly level with the top of the chucked wood block. Lower it as the block is shaped down. To avoid metal-to-metal contact that could damage the tool's small teeth, cover the edge of the rest with a layer or two of adhesive tape or a piece of garden hose slit lengthwise.—*Harold Rolseth, Pewaukee, Wis.*



Mat Cushions Tool Chatter

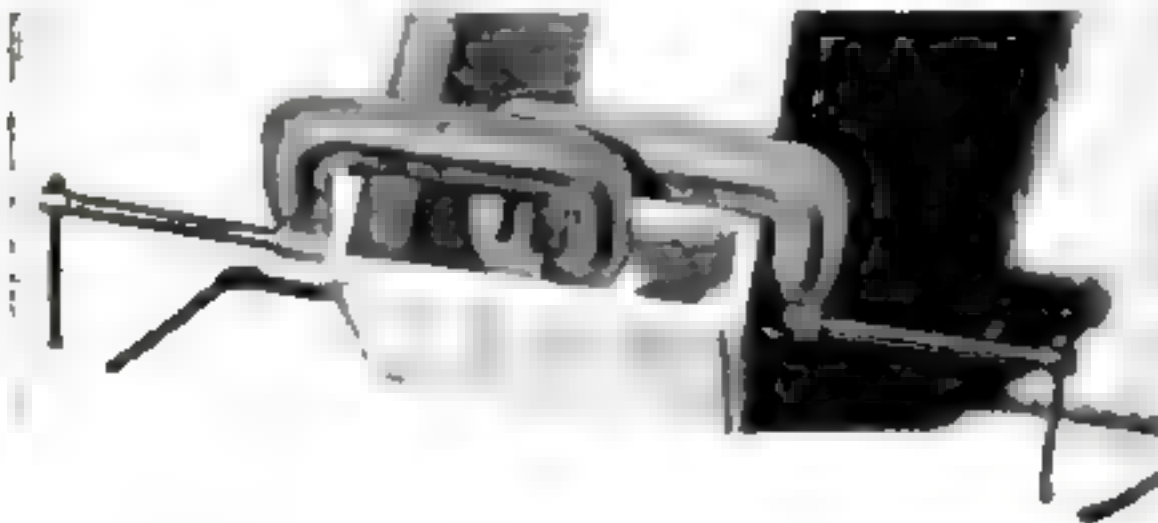
THE rattle of tools or loose parts that are resting on a machine while it's running can set your teeth on edge. The vibrations also cause such items to "walk"; you have to keep sliding them back from the edge to keep them from falling. Both problems are easily solved with mats of $\frac{1}{4}$ " foam rubber. You can attach them to the tables, beds, or stands of power tools with rubber cement.—*Hugh F. Williamson, Metairie, La.*

Short Cuts and Tips

FROM PS READERS

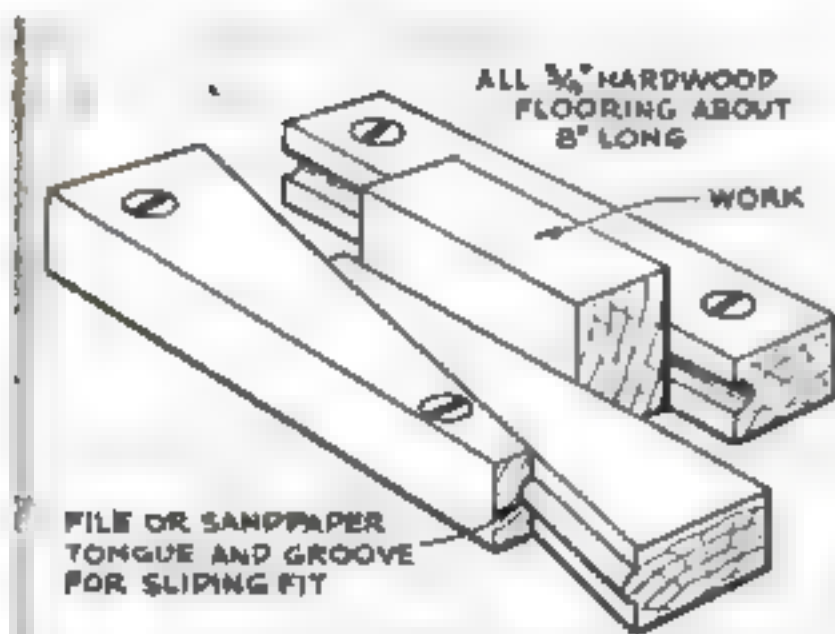
Washing-Machine Base for Low Bench

FOR many shop projects, the workbench is too high. Rather than stoop to the floor, I salvaged the base of an old washing machine. Half an hour's work and a coat of paint gave me a knee-high bench that saves a lot of reaching. A bonus: The holes in the base turn out to be quite useful.—*R. Bench, Lake Grove, Ore.*



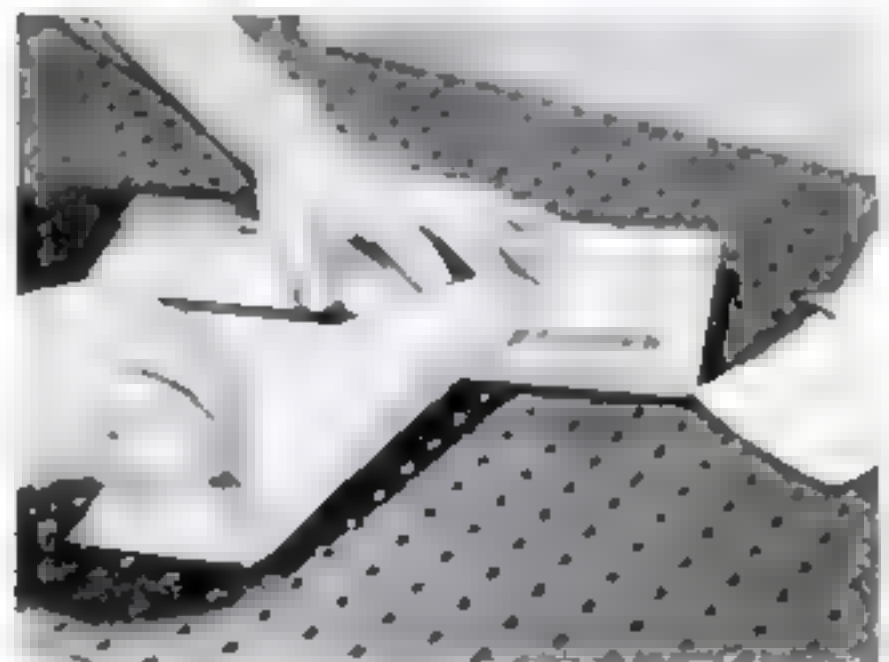
Two Small Clamps Replace Large One

EVER get work all glued and assembled only to discover that its thickness was beyond the capacity of any of your C clamps? Next time, try linking a pair of clamps jaw-to-jaw to span the distance.—*Gordon Nelson, Gladstone, Mich.*



Wedge Vise from T&G Flooring

FASTEN two scraps of hardwood flooring to a bench top, as shown. The third can be tapped snug to hold work for edge planing. The mating of tongue and groove keeps the angled edge from springing up. Leave the groove on the inside edge of the backstop; it improves holding power.—*Archibald Black, Stafford Springs, Conn.*



Sandpaper Cutting Board

THIS jig cuts sandpaper sheets into strips the size my pad sander requires. A $\frac{1}{4}$ "-plywood stop and an old hacksaw blade are properly spaced on a $\frac{3}{4}$ " board. I slip a full-size sheet under the blade till it butts against the stop, press down on the blade, and give the paper a tug.—*R. J. DeCristoforo, Los Altos Hills, Calif.*

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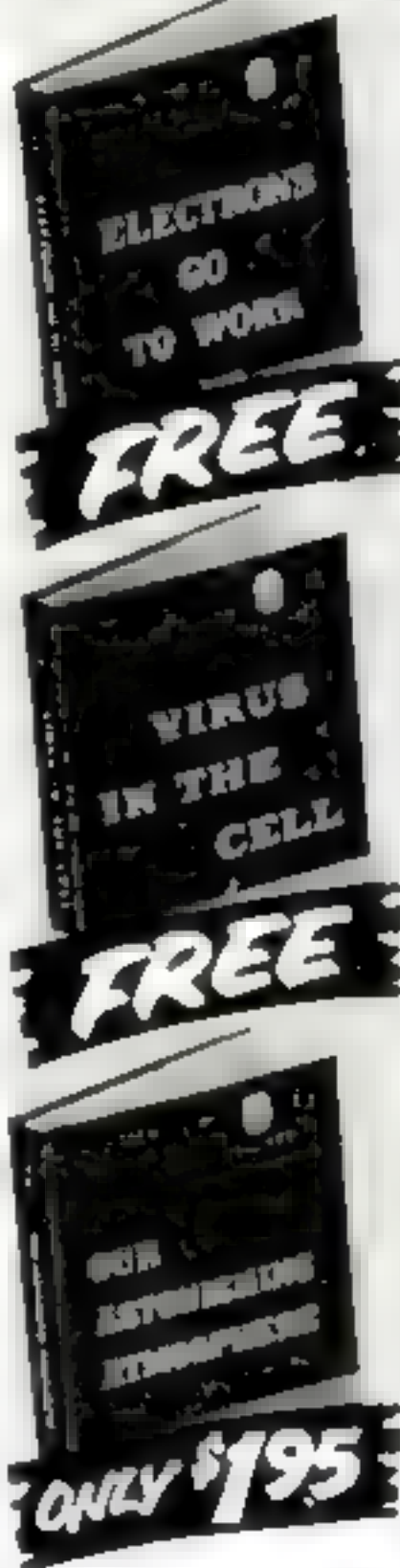
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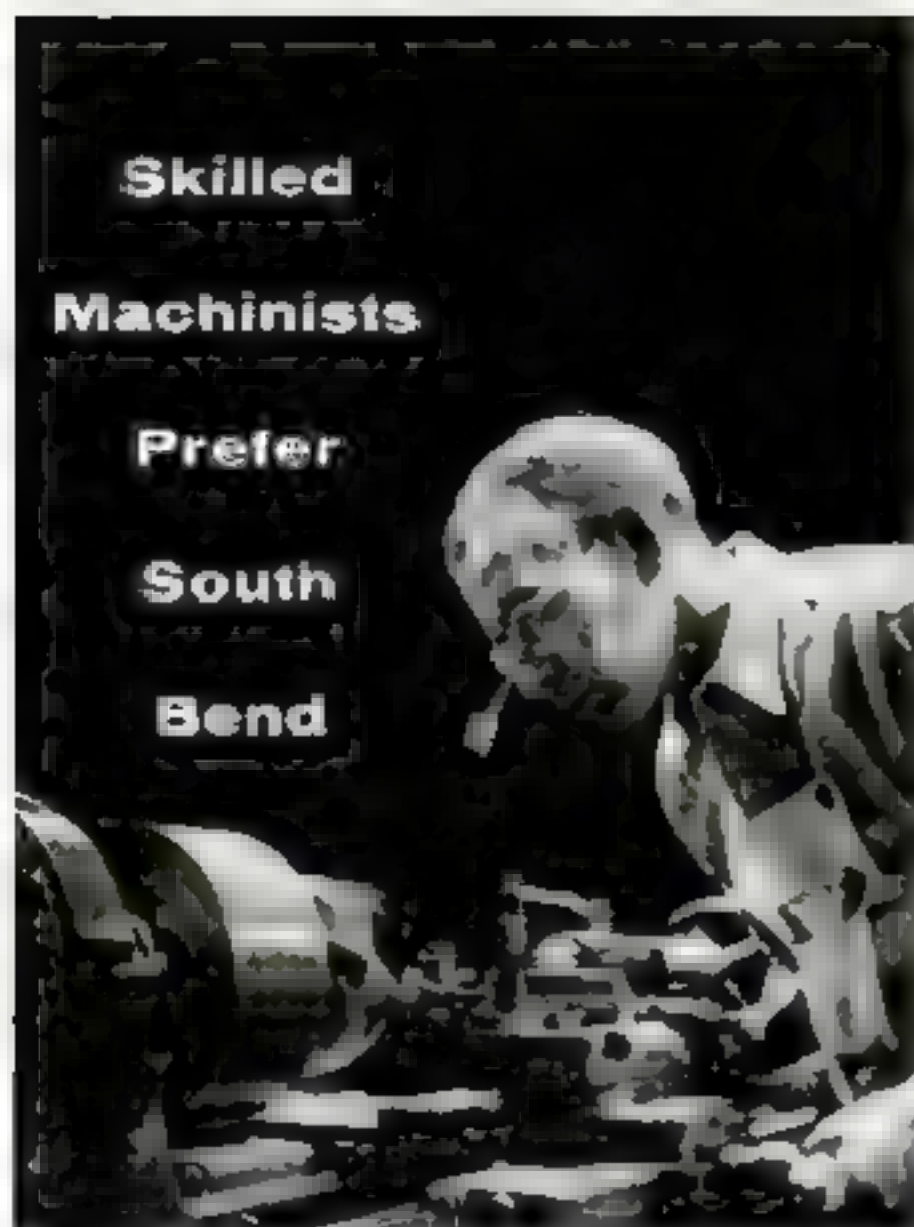


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Exposing Crooked Gamblers' Tricks

[Continued from page 66]

trousers or hooks under the edge of a table. In two seconds the cheat can exchange bad cards for good.

The ultimate in machinery: Then there's the radio cue-prompter—a little \$350 toy that partners use. The sender clicks out a coded signal (maybe he's hidden in a closet with a one-way mirror). The player feels a few mild shocks from the cigarette-pack-size receiver strapped to his leg.

Now what about the real sharp—the expert who's beyond the stage of gimmicks? (Manufacturers admit that some of the gimmicks are pure sucker bait.)

The picture is dismal, as **POPULAR SCIENCE** photographer William Morris and I can report. We watched Sidney Radner go through a demonstration of the card sharp's repertoire of fancy deals, shuffles, cuts, and quick-change acts—plus a few that Radner alone can master. Our verdict? If you get into a game with someone as quick-fingered as this you might just as well throw in your hand—and your wallet. But here at least is what to look for:

The peek. It's nice for the cheat to know what card is coming up next when he's dealing. He can if he masters the fast left thumb action that buckles the corner of that waiting card just enough to permit a peep while he's busy dealing the top card. Once the cheat masters this he can follow through with . . .

The second deal. Suppose the game is stud and the cheat sees that the next player due for a card has an ace showing. The cheat has already peeked and seen an ace coming up. Does he deal it? Not at all. He holds back the ace—now on top—and with the smoothest of movements doles out the second card.

Bottom-dealing is another neat trick the sharp uses, especially if he's kept a stock of interesting cards there to feed himself.

Sometimes the hustler, out of laziness or inability, may deal in an ordinary way, straight from the top of the deck. Ordinary, that is, except that he manages to pick off an extraordinary number of cards for himself. While the suckers play with five cards, he may have eight or nine. It's not sure-fire, says Radner, but it's a good percentage way to play. Rest

Exposing Crooked Gamblers' Tricks

assured the cheat can dump the extras just as neatly as he picked them up.

Transfer this kind of sweaty-palmed artistry to dice and you have the time-honored ways of cheating in a crap game. The difficulty in dice is not so much rigging the cubes as getting them into a game. This is where the slightly grimy, moist palm helps. In one gambit the sharp works with two pairs of dice: one "square," the other gaffed. (They're always sold in matched pairs.) At his turn the hustler gathers in the square pair between his thumb and forefinger and lets them jostle against the waiting percentage pair. He rattles the dice (all of them) in an authentic way, and then lets go—with the back pair.

Other dice tricks. If four dice are too clumsy to handle (as they will be if the game is played with the large precision dice that honest gambling houses use), the cheat may choose to work special combinations of three dice: One pair may be loaded for threes and fives. They make a fine passing pair, favoring sums of six, eight, and ten. A third die, kept in reserve, is the "shifter." It may be loaded in favor of two and four: The cheat can switch in that die to replace one of the passers if he wants a player to miss out after his first throw. (They'll favor seven.) Or he may use them himself after he's cleared a decent profit and wants to avoid suspicion.

Once a dice sharp masters the switch (and there are lots of variations he can adopt, such as hiding the action under some loose dollar bills or dropping his hands under the table), he can carry around as many as six or eight sets of dice on a special dice belt. Or, working with a confederate, he can be fed pairs during a game. Most crap games move so swiftly that the risk is not as great as it seems.

The Army game. Occasionally a hustler doesn't play at all, but discreetly leaves a pair of crooked dice around to trigger a game. This was a favorite Army trick. The hustler then makes his money by seeming to give sucker odds in side bets against the shooter.

The pair he leaves around may be doped in countless ways and the catalogues offer a spread of possibilities for each—light, medium, or heavy. As Radner

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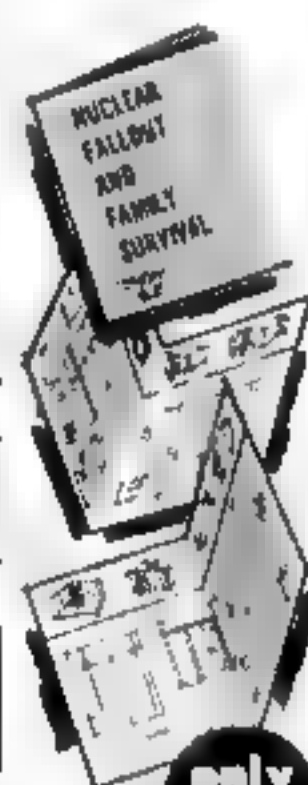
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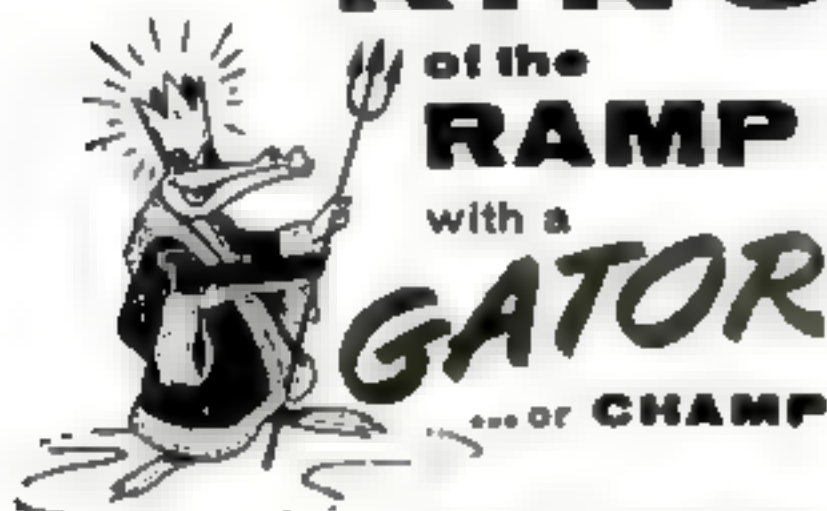


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Exposing Crooked Gamblers' Tricks

says, you use the lights with your friends, the mediums with acquaintances, and the heavies if you're going to get out of town fast.

The terms are general. They may refer to actual weighting of the dice (by drilling and filling certain spots, sometimes with transparent material). Or just the opposite: hollowing out some parts. Sometimes cautious bettors have dropped dice in glasses of water to let gravity expose the load; the dice would turn over, heavy side down, as they sank. The story is told that one cocky gambler submitted his beauties to the test only to be chagrined to see them float.

Another way of tampering with the insides of dice is to inject metallic dust.

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Next Month: Could you defend yourself if you were attacked by someone bigger than you? The surest defense is a sound knowledge of the simple measures, based on judo, that enable you to turn your opponent's movements against himself. For 12 illustrated lessons on the art of unarmed self-defense—specially adapted from the \$3.95 book by Harry Ewen, a top police instructor—see February PS.
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One partner will shoot the polarized cubes in the general direction of his pal who's wearing a magnetic apron tucked inside his trousers. Magnetic dice can also be used for permanent table-top games. Here the sharps can set up remotely controlled electromagnets which they can turn on (for them) or off (for you).

Other educated dice are made by doping the outsides. "Flats" result from shaving off one dimension slightly (30/1,000 inch at the most). The result is a die with a pair of oblong faces whose extra surface area is just enough to encourage a fall on those sides. (Usually the six-ace sides get the treatment, to be used to make the other fellow seven out.)

The dice that can't lose. One seemingly idiot-obvious but effective way to cheat is to use "tops"—dice marked the same on their top and bottom sides. Very common are one-three-five tops. Used in pairs, the dice can never make a

Exposing Crooked Gamblers' Tricks
seven (or any odd number, for that matter) so they are sure-fire winners. Of course the hustler will use these for only a short time, bringing in a square pair when he's made his haul.

Except once—when a dupe conned into using tops in a game by two pros decided he wanted more than the agreed-upon share. The two hustlers merely shrugged their shoulders and walked away—with the square pair.

Nobody knows what ever happened to the greedy man who could play until doomsday and never lose.

Trick shots with dice are as possible as fast deals are in cards. Spins, rolls and other fancy plays are possible even when the player is forced to hit the dice against a backboard (which, incidentally, makes loaded dice work even better).

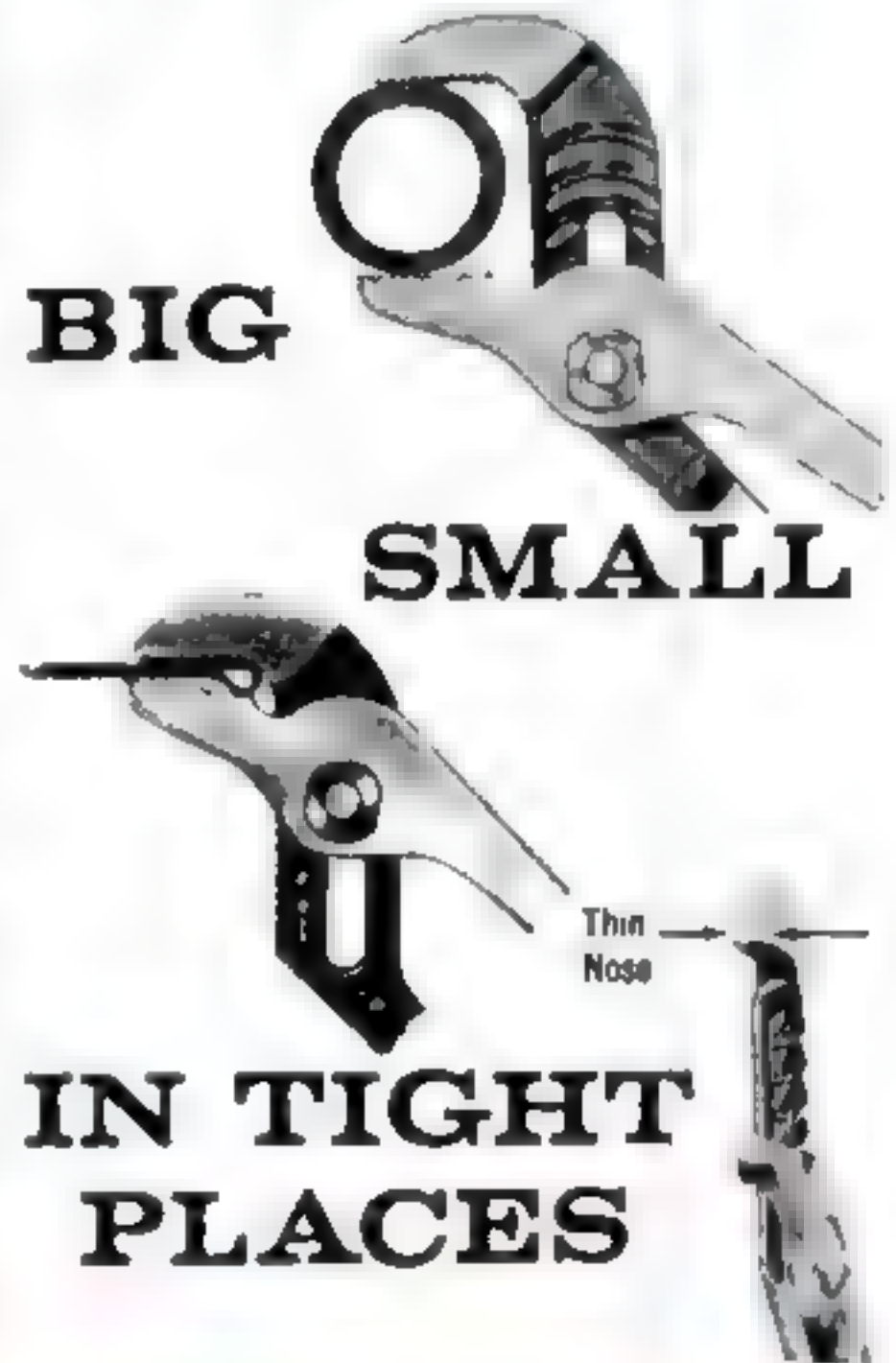
Even the experts will admit they aren't wise to all the possibilities, and can only speculate on how much cheating actually goes on. Scarne's educated guess is that one out of every 20 crap games is phony and that 400,000 marked card decks are in use in the country. He adds ruefully that at least 100,000 cardsharps are "perfect."

Don't gamble. In view of this, the best advice such professionals can give is not to gamble at all. As for men like Radner and Scarne, when they're not acting as consultants to government officials or lecturing the public, they polish up their skills by playing and trying to cheat each other.

In one such contest Radner reports that the players got points by their ability to catch and name the exact cheating method used. Things were going fine for him and he soon found he was top winner facing one opponent. The other fellow tossed in his hand and, with an air of great bravado, suggested they cut for one final all-or-nothing bet. Radner agreed, and—you guessed it—the other fellow cheated and won. ■ ■

Reading the Marked Cards: The trickery is in the petals of the left-hand flowers. Top one is unmarked. Center one has top petal slimmed—that's an ace. Bottom card shows the next petal in clockwise direction slimmed—that's a king. Marks go in order around the circle. Small denominations are marked by blocking out the bottom of the petals.

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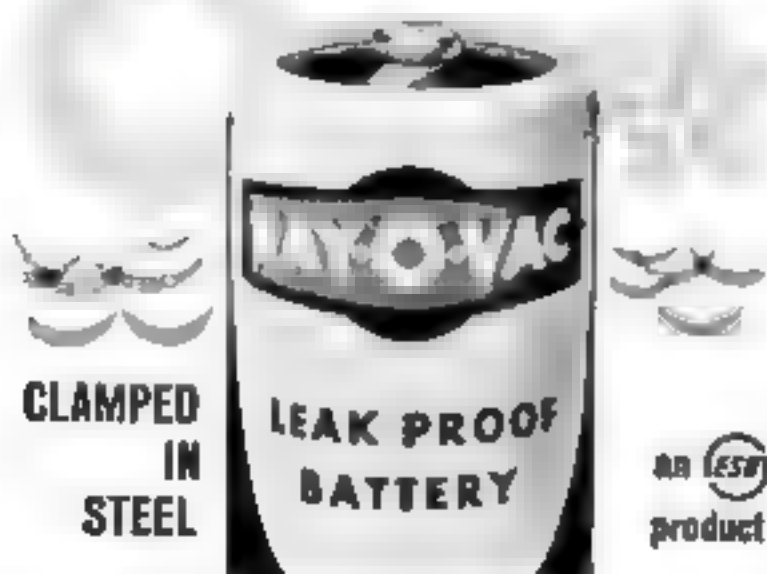
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Cold Facts About Snow Blowers

[Continued from page 81]

reports of snow-induced heart attacks. In rough going, a you-push-it is not much of a heart saver.

Picking a self-propelled. All machines look magnificently capable when they are crouching on a showroom floor. While firing one up there won't tell you what it can do in snow, it will at least give you an idea of how different models compare. Try bulldogging each one to a wheel-spinning stop to see how hard it fights you—the harder the better.

Some machines are geared down to give fantastic pull. I tried holding onto one while sitting on the bumper of my Jeep with the brakes off. We really moved, although at some cost to where I sit.

Still, dry pavement isn't snow. Be prepared for the dealer's counsel that an extra 10 bucks for snow chains is a wise investment—it is. But watch your step on this one: A few makers will hastily convert a pusher into a self-mover by merely adding a belt to the wheels without giving you a corresponding increase in power. Obviously, you gain nothing with a rig like this.

The power plants. Engines are mostly well-known standard makes, usually Lauson or Briggs & Stratton. You'll hear a good bit of debate over the respective merits of two-cycles vs. four-cycles when the mercury dips to the finger-numbing level. Jacobsen, which makes its own two-stroker, claims easier starting on grounds that you aren't bucking a stiff load of congealed crankcase oil. The four-cycle crowd put forward the classic objections to a temperamental ported engine, adding that old oil from the fuel mix clogs carburetor jets.

The fact is, on new or well-maintained engines, there's very little difference. However, noting a certain human tendency to ignore the handbook rites for proper care, I checked a number of machines brought into service shops in advanced stages of neglect. Under these conditions, the four-cycles seemed to be a bit more tolerant of abuse.

Several machines this year have impulse, or wind-up, starters. A few offer optional 110-volt plug-in starters to speed you off. Another aid to easier starting found on some machines is a centrifugal

Cold Facts About Snow Blowers

clutch that doesn't pick up the load until the engine achieves working revs.

One problem with all the big self-propelleds is that they've outgrown simple cellar storage. They'll want their own parking place at ground level, preferably a warm and dry one.

Power reverse? Fancier self-propelleds have not only several speeds forward, but also a reverse gear. The latter is handy when you're nibbling your way down a steep slope and want to back up—it saves a lot of heel-digging.

I learned the importance of this when one of my early no-reverse machines got out of hand sailing gaily downgrade at full throttle. In panic, I finally had to put the brakes on by ramming the nearest tree, amid a shower of bark and blades.

If you don't have a major grade problem, a power reverse isn't really needed. But with or without a reverse, there's another important moral: You have a lot more voice in developments when you go upgrade under power, rather than down.

If there's no power reverse, be sure there's some sort of power release—usually a ratchet or overrunning clutch—

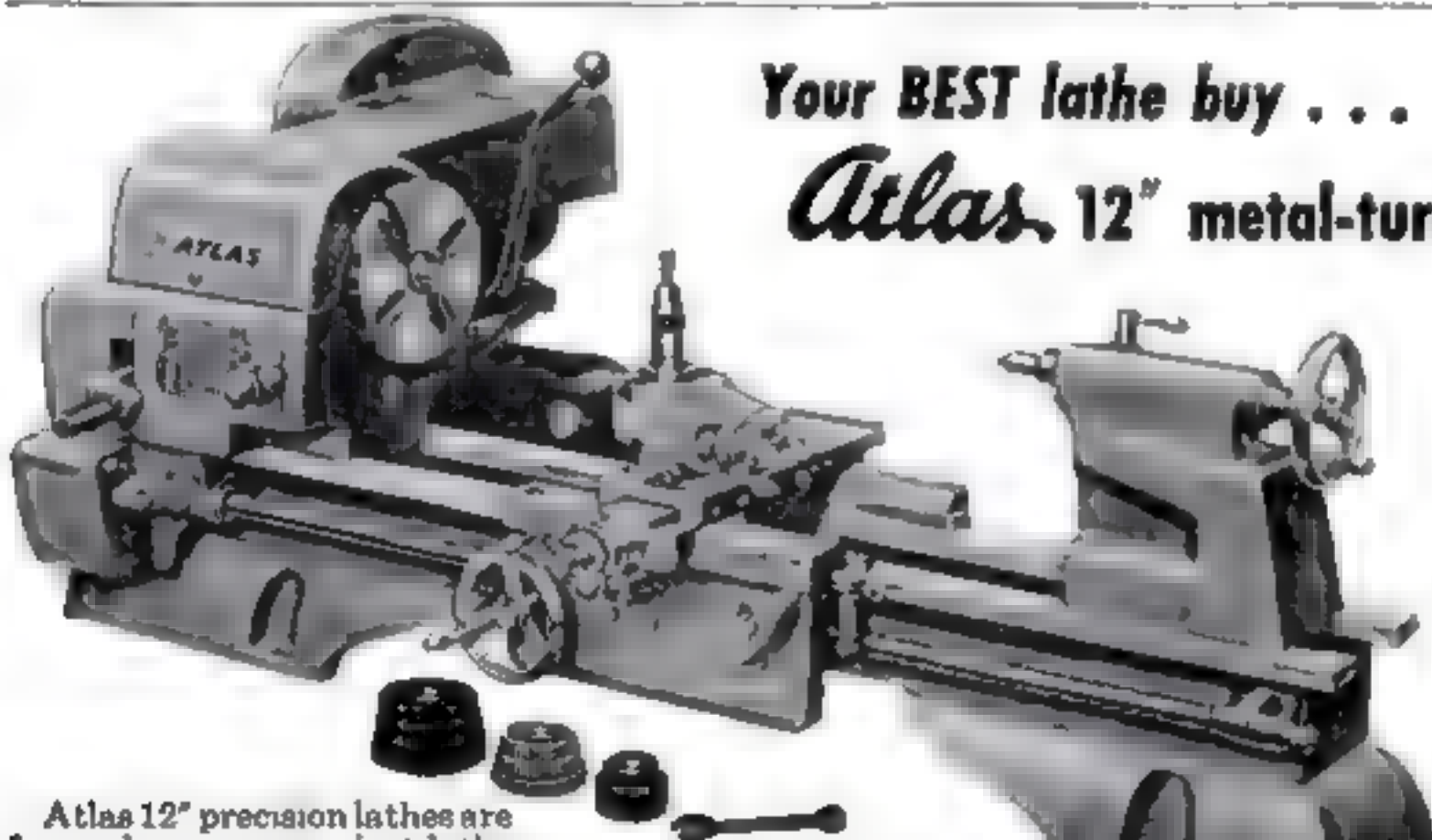
that lets you haul back on the machine without dragging the wheels. This enables you to chew away at big drifts a bite at a time by alternately nosing in and backing out.

Make sure, too, that the snow blades are powered independently of the wheels. In some of the earlier and cheaper models the blades were geared directly to the wheels. When the wheels stopped, everything quit. Most modern machines now have separate clutches on the wheels and blade to overcome this.

How big a bite? You should expect to cut a swath 20" to 22" wide with a good self-propelled, at least 16" with a hand-push type. Most scoops will handle snow up to 17" deep, though a few stop at 14". Still, there's no guarantee that a machine's capacity is as big as its bite.

In the little hand-pushers, the snow-eating mechanism is little more than a sheet-metal paddle wheel that slings the stuff to one side. The more sophisticated self-propelleds have a screwlike blade, called an auger, that draws the snow into the scoop and forces it out a discharge

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Cold Facts About Snow Blowers

chute. Blowers that use only this auger are called single-stage machines. A few blowers have an additional vaned rotor to help sling out the snow picked up by the auger. These are known as two-stage machines.

Two-stage makers argue that the added rotor gives more power. The auger-only people make a virtue of the single stage, claiming that you don't waste power trying to drive two separate mechanisms and that service headaches are fewer because parts are simpler.

Repair shops bear out to some extent the simpler servicing of single-stageers. Otherwise, both types can be equally good if provided with adequate power and are well designed in other respects. For any self-propelled, don't settle for less than three hp., with more desirable.

Look for little adjustable wheels or shoes on the scoop to vary its height and avoid crack-stubbing. Even so, the scraper blade will eventually wear or dent—so be sure it's replaceable. Check for balance, too, especially on hand-propelled where you're the sole boss. A nose-diver or tail-squatter is hard to keep level. On self-propelled, push power will depend a lot on wheel size—the larger the better. The more reliable machines have wheels 10 to 12 inches in diameter and 3 inches wide. Tires should have heavy tread, either knobby or herringbone. Sturdy push-rod controls for throttles and shifts are more positive and trouble-free than flexible-wire cables, which rust out—no matter what the salesman says—in a few seasons.

Check the snow chute. The fixed chute on cheaper models sprays snow in only one direction and requires considerable course plotting to keep from filling in the path you've just cleared. The two-way teeter-totter chute tilts right or left, but still limits you to a straight-out throw from the machine's side. In a high wind, this can blow back snow, undoing the work behind you.

The swivel chute lets you call your shots in any direction. This is important, I've found, because often the best angle is about 45 degrees to leeward of the bow, which puts the discharge ahead of you as well as off to the side.

Other differences are largely frills. Some chutes adjust a bit more easily—

remember, you'll be wearing heavy gloves. Several makers put a fancy remote-control crank on the handlebars so you can aim the chute like a gun turret. All chutes, regardless of type, should have a little flipflop shield at the end to control height and distance of throw so you can hold it low in a wind or keep it from showering your neighbor.

How safe are they? Most makers have been careful to put the obvious finger traps behind metal shrouds. This, of course, won't protect you from unusual stupidity, such as poking an arm down a chute or dangling a Bob Cratchet muffler into the auger. You have to use sense.

The most important point to remember is that the whirling blades can sling out a rock or last summer's dogbone with bulletlike force, just like a power mower. Don't let kids play in the snow shower.

Most auger blades are protected against sudden jam-ups by shear pins that let go like those in an outboard prop. Some dealers I talked to reported the problem of pins popping when they shouldn't, under the weight of last winter's heavy snows. But this isn't serious. A few deluxe machines overcome it by using slip clutches that do away with shear pins.

Tractor combos. If you own a large lot or go in for gardening, you may want to consider one of the appealing little tractor-plus-attachments combinations. Makers like Simplicity, Gravely, and others offer husky two-wheel walking tractors to which a snow blower can be fitted, along with a staggering array of other accessories. Another step up are four-wheel riding tractors with attachments.

You pay more at the start—\$500 to \$900—but you end up with a really versatile rig. One of the slickest of the convertibles, though not a tractor, is Toro's detachable power-handle that can be fastened to half a dozen implements. It goes for about \$85, with a self-propelled blower for \$115.

Blower makers report a fantastic 400-percent leap in sales in five years. Why the boom? Health-induced—sure. The status-symbol drive—maybe some. But I'm convinced that a good part of it stems from the thrill you get striding along behind a roaring, snow-spewing gas eater while its reassuring warmth defrosts the icicles on your chin. ■ ■

The Death-Ray Bomb

[Continued from page 91]

It is about 1/10,000,000,000,000 inch in diameter and—unlike its companion parts inside the atom—electrically neutral.

Neutrons are absolutely harmless where they belong, inside atoms. When they start flying around loose they can be deadly, mainly because their lack of electrical charge permits them to fly long distances.

Neutrons can pass between atoms and through atoms without being attracted or repelled by the electric charges on other atomic parts. They travel through air, water, clothing, steel, and concrete almost as easily as light travels through glass. It takes about three feet of damp earth to screen out enough neutrons to reduce a lethal dose to a harmless one.

The only thing that stops a neutron is a head-on collision with the core of an atom. When that happens inside a human body, there's trouble. The struck core gets knocked forward, ripping itself and many nearby cores away from the atoms to which they belong. If enough of your atoms get torn apart, you die—even though the injury can not be seen immediately.

HOW is a death ray generated? The fusion reaction that gives the hydrogen bomb its terrifying power makes neutrons—floods of them. That is all fusion does, in fact—generate neutrons, heat, and light. In bombs designed for massive destruction, the neutrons are a waste: Any victims they might kill would already be incinerated by heat or crushed by blast. So big H-bombs are blanketed in plutonium. Neutrons from the fusion reaction cause plutonium atoms to fission, generating more blast and heat.

For the N-bomb, the reverse tack would be taken. The bomb might be left "bare," so that all the fusion-produced neutrons get out. It might even be possible to find some blanketing material that would increase neutron production without increasing blast.

The death rays could also be concentrated on the target by a built-in mirror, the way light is focused by a searchlight reflector. Neutron reflectors are standard equipment on bombs and reactors (for a different reason). You

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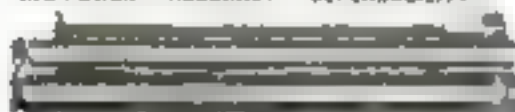
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The Death-Ray Bomb

might think that the reflector couldn't stay in one piece long enough to do its job. Yet apparently it might. According to published data, "essentially all" a bomb's neutrons come out in "less than a millionth of a second." It takes longer—"a few millionths of a second"—for the bomb to vaporize. A one-megaton bomb needs 700 millionths of a second before the fireball grows to 440 feet.

To block unwanted heat, the N-bomb might release smoke just before it went off. A good smoke screen filters out 75 percent or more of heat radiation.

The stickiest difficulty with the N-bomb is its detonator. The neutron-generating fusion reaction requires fantastically high temperatures to get started—around 100,000,000 degrees (Fahrenheit or Centigrade; at this temperature it doesn't matter).

The only way now known to reach such sunlike heat is by exploding a fission (atomic) bomb. Fission causes heat, blast, and worse, radioactive fallout—all of which the N-bomb should avoid.

Less drastic triggers are being hotly sought. Shaped charges of TNT might just possibly set off the fusion reaction. And the U.S. has already spent almost \$200,000,000 on electrical methods (in the continuing attempt to harness fusion to peaceable power generation). The pure N-bomb must wait for success with one of these ideas—a couple of years certainly.

IN THE meantime, a crude yet effective N-bomb could be made with what engineers call "the state of the art." This bomb would be small, maybe no more than one kiloton (equivalent to 1,000 tons of TNT). It would use the fusion reaction, modified to boost the output of neutrons while limiting blast. It would contain the smallest possible fission detonator (perhaps less than 10 pounds of plutonium). It would be rocket-launched and set to go off fairly high above the target—high enough to reduce blast and fallout damage, yet low enough to let most of the neutrons get through to the ground. A device like that could be tested next year.

If it's any comfort to you, the N-bomb is unlikely to become a Moloch destroyer of humanity. Existing bombs can already do that all too well. ■ ■

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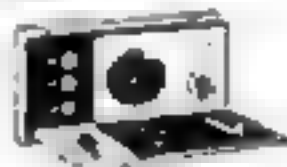
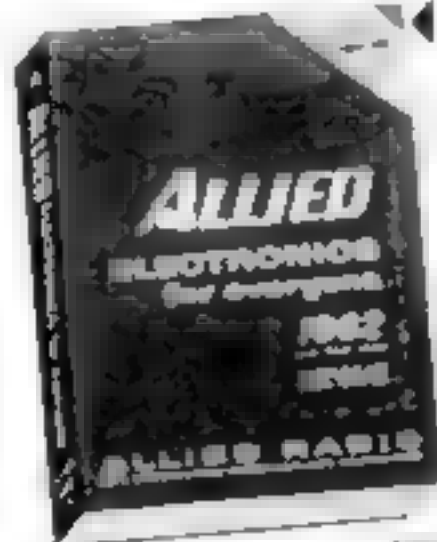


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of the same route with a volcanic material called pozzolana. Processed from pumice rock, it's added to the cement, which it resembles, to reduce shrinkage. Also, it gives off less heat during curing.

Still a third parade—this one of 30-ton dump-bottom rigs—snakes along the west wall of the canyon, hauling aggregate from a gravel pit six miles upstream. Fourteen of the big Macks will have made a third of a million cliff-hanging trips by 1963.

At the batch plant, where all the tonnage is siloed and binned, an operator in a dustproof cubicle studies his daily schedule. Then he punches buttons on a 72-control console. Everything—conveyors, feeders, classifiers, pumps, screens, and fans—is operated electronically. Wrapping up the act, the tower boss can select any one of 12 concrete recipes with the touch of a finger, and six mixers will crank it out.

Cool operation. In a canyon where summer temperatures top 110 degrees, irregular shrinkage would play havoc with setting concrete. The heat generated chemically within the gigantic slab would be even more damaging.

That's been scotched. To keep batches cool during pouring and curing, a refrigerating plant will turn out 600 tons of ice every hour. A wishful-thinking maintenance man has figured that this would be enough to frost 12 million tall drinks with three one-inch cubes apiece. The actual purpose of the plant is to add flaked ice to the water in each concrete mix. In addition, aggregate entering the batch plant is given a near-freezing shower bath. Finally, cold water is pumped through a vast system of coils bedded in the dam. Altogether, 900 miles of aluminum tubing will be used for the job.

Two other tricks insure a crackfree structure. First, the dam isn't being poured in one solid piece. Instead, it's made up of a great many individual blocks, the largest 70 by 160 feet in area, and all of them 7½ feet thick. Those in one tier are allowed to set and cool before others are poured above them. Joints are bonded with a mix of cement and water pumped into the seams at high

pressure. Second, the steel forms confining the wet concrete are coated with a highly insulative asphalt product.

Reinforcing steel is strangely absent in the dam. Engineers say it isn't needed. The great weight of Glen Canyon's concrete—almost three times that of Hoover Dam—provides its own strength. The intricately honeycombed power plant, however, is being laced with rod assemblies.

Byproduct: outdoor fun. The first surge of power generated at the plant will go into the line in 1964. By that time the reservoir will have backwatered almost to Moab, Utah, the uranium capital of the world. A second leg will creep up the San Juan River to a point near Mexican Hat, the northern gateway to spectacular Monument Valley.

The enormous body of water will be called Lake Powell. It was explorer-scientist John Wesley Powell who first ran the treacherous rapids of the Colorado River system, in 1869. He, too, gave Glen Canyon its name, to describe the beautifully foliated ravines he found all along this section of the gorge. Now, nearly 100 years later, millions of motorists, campers, fishermen, and boating buffs will have a chance to share his enthusiasm for the region—thanks to the new colossus of the Colorado. ■ ■

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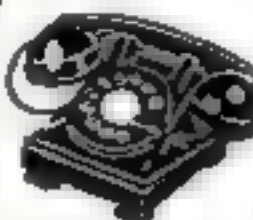
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10,000 Miles in a Chevy II

[Continued from page 73]

and quiet most of them—all it took was a little judicious bending. At first I thought the engine was simply out of balance, and then I discovered that the crankshaft V-belt pulley had a 3/16-inch wobble.

Griswold: One buzz came from the clutch linkage. They've got the cross-arm loosely pivoted on the side of the block.

Francis: I suppose it's niggling, but the vent pane on the left was so stiff that it chewed up your fingers.

Fay Rowsome: Well, I thought there were a lot of good things about the design. The seats were comfortable. Imagine doing 800 miles a day in a little car and not crawling out all stiff. The heater came up fast and the defroster worked fine. I liked having plenty of trunk space.

Griswold: There's excellent headroom and good-enough leg room. You get in and out without bending double.

Mann: I'm just not convinced that the gearbox is right for this four-cylinder engine. Low is 2.94:1 and second is 1.68. That's just too far apart for a little engine without much low-speed torque.

Lockett: It's a point. What compounds the trouble is the 3.08 axle they're using—which favors economy and a fast cruise. I could give up a little on each of those for better behavior around town.

In Conclusion

Rowsome: If I get the sense of the meeting, the Chevy II is a remarkably contradictory car. More exactly, it is contradictory in this version—a four, with a three-speed manual shift and a 3.08 rear axle. The four with an automatic, or the six, may have altogether different personalities.

The power-plant combination aside, it is a pleasant car. It steers beautifully, handles well, and rides adequately. Fuel and oil mileage are excellent. The design is mostly good, construction fair. ■■

Effective Nov. 27, 1961, according to Chevrolet, running changes were made in Chevy II. Among the ones applicable to the four-cylinder, manual-shift version: carburetor and manifold modification for smoother traffic behavior, an "anti-rattle washer" added to the shift linkage, and change of the rear-axle ratio to 3.55:1.

Space Cameras on Peace Patrol

[Continued from page 79]

raphy, for taking sharp pictures of the ground through thick clouds. And the Army Signal Corps has demonstrated reconnaissance television with a battle-field surveillance camera in an unmanned drone plane. Such cameras may be adaptable to later satellites.

An advanced test version of another intelligence satellite, a sister of Samos, is also now at work; it is Midas IV (for Missile Defense Alarm System). Air Force officials were jubilant last October 21 when it went into a high polar orbit that enables it to scan a wide area of the Soviet Union and Red China on many of its 170-minute trips around the globe. From a height of 1,850 miles, Midas' sensitive infrared-ray-detecting equipment can distinguish between the furious heat of a missile launching and ordinary heat sources on earth, and flash back an instant, automatic alarm.

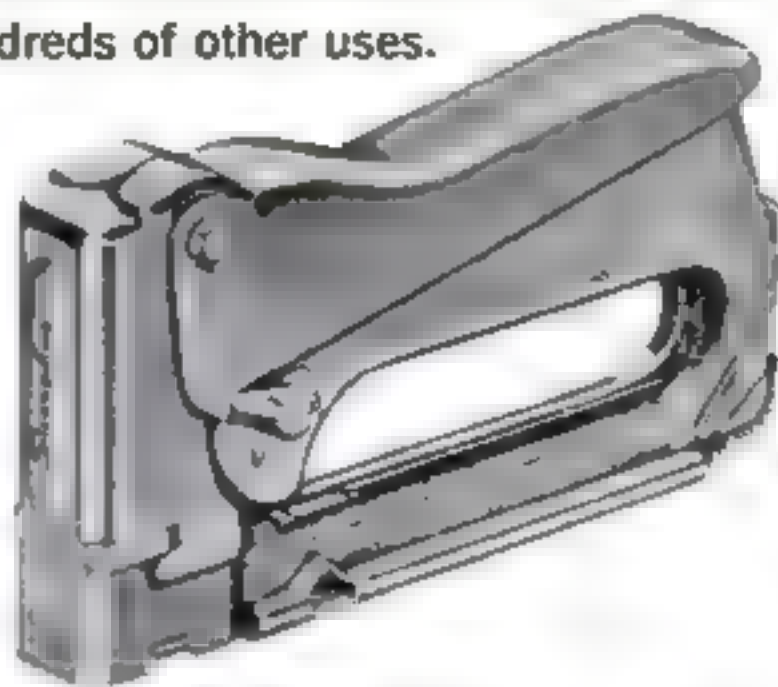
Cloud-shooting cousin. Getting space photographs back to earth is being achieved on a large scale every day by Tiros III (Television and InfraRed Observation Satellite). Tiros is a hurricane-hunting cousin of Midas and Samos. With two wide-angle cameras and television equipment in its nose, Tiros III snaps scores of photographs of cloud formations from 450 miles up as it circles the earth on a path 48 degrees north and south of the equator. Some of the pictures are scanned and transmitted by radio immediately. Others are stored on magnetic tape and radioed down to control stations on command. By detecting the first signs that a violent storm is being spawned, Tiros is opening an important new chapter in world weather forecasting. The pictures are freely given to any nation that wants them, and most of them do. Meteorologists from 100 countries attended a meeting in Washington in November to work out plans for a globe-girdling weather network based on Tiros data.

The Tiros pictures are too small to detect evidence of military activities, and some quality is lost in radio transmission in any case. For those reasons a method is being sought to send down the exposed film itself. That was the purpose of the Discoverer tests which have had airplanes chasing around over

[Continued on page 217]

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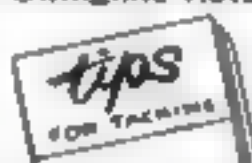
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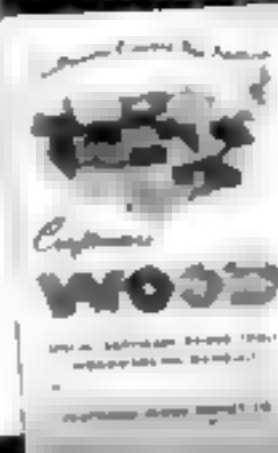


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the engine, let go to speed up. This takes a little getting used to and eliminates the advantage of being able to idle the engine between jobs. No doubt the reasoning behind it is that most operations would require full throttle anyway—which does make sense. But a better arrangement might have been a non-spring-loaded throttle that would hold in any position. An idle setting on Comet's saw would be welcome in the same way, enabling you to "park" it without shutting it down and restarting it each time.

From Skil: a whole battery shop. Skil's six new battery-powered tools, not yet available for a firsthand report, will start appearing this spring. First to come will be a hedge trimmer tagged at about \$60. The battery pack will go for another \$50 and a charger for \$15.

While this isn't cheap, Skil is counting on the appeal of a separate power supply, pointing out that you need buy only one to run a number of different tools. The separate battery, bigger than you could build into the tool itself, is also said to cut tool weight and make possible "performance that is equal in all respects to conventional tools that plug in."

What are they good for? Self-powered tools have both advantages and drawbacks. None of the tools tested is a substitute for a conventional shop tool—nor are they intended to be.

B & D's cordless drill, admittedly underpowered for some jobs, is nevertheless a fine tool for brief work around boats, on a summer cabin, or up on a ladder or rooftop—anywhere that you're not too far from that recharging wall outlet. One PS user was delighted at the freedom it gave him in working on his car—parked right in his own driveway. It got the job done in less time than it would have taken to string an extension cord. Skil, with its new hedge trimmer and grass shear, will broaden the convenience of battery power still further by simplifying yard chores as well as shop jobs.

The gas-powered saw and drill are a different breed. They're rough, tough

outdoor tools; they make no apologies on power. They're great for jobs where you may be away from civilization for days or weeks at a time, such as building a cabin in the wilderness. At the same time, they're not the sort of tools you pick up around the home to saw a quick board or drill a single hole—conventional tools are still more convenient for that. They're also not housebroken—their smoky blue exhaust trails rule out indoor use.

Both the battery and gas tools have the added advantage of being completely shockproof, making them ideal for safe use near water, in wet grass, and in foul weather. All are a fairly hefty investment. In the end, you must decide if your needs call for the special virtues of cordless power. If they do, price is the smallest thing about these remarkable tools.

Design-it-yourself lighter. Remember the fellow in last November's PS who built a cigarette lighter into his own carved-wood table decoration? Well, now you can buy a kit made just for the purpose. Shown below, it includes a table-model butane lighter without base and a



metal ferrule to hold it in a hole. The idea: You supply the base—a wood turning, fancy jar, piece of marble, etc.—and build the lighter into it. For temporary use, the kit also supplies a plain wood ring to hold the lighter. \$12.50, Ronson Corp., Woodbridge, N. J. ■ ■

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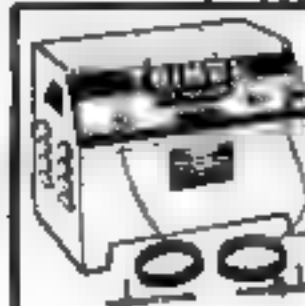
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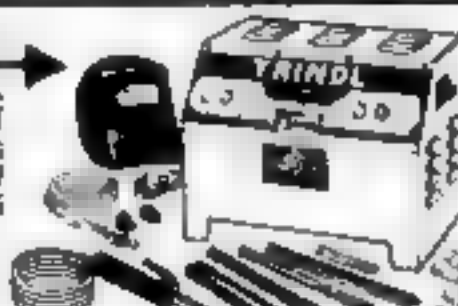


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Space Cameras on Peace Patrol

(Continued from page 213)

the Pacific like outfielders after a high fly, and catching capsules ejected from satellites as they whirled through space. (So far, 10 have been recovered.)

Patrolling the sky. There are more developments, more tests to come. But within two years, if all goes on schedule, both Samos and Midas will be at work regularly patrolling the planet, Midas watching for enemy missile firings, Samos alert for significant buildups of troops or materials of war. Each is designed to operate as a system of four or more satellites, all in polar orbits and spaced so that the entire earth can be under surveillance all the time and the present 15-minute warning of a hostile missile firing will be at least doubled.

The drive to develop space sentries has cost vast sums of money—the Samos development alone over the past 3½ years is reported to have cost 300 million dollars. But it has been spurred by the conviction that survival of the free world may depend on its success, and that the perilous tension that envelops the globe can be relieved only by plain evidence, made available to all nations, that no major sneak attack is brewing anywhere. The Reds vetoed the U. S. proposal for an "Open Skies" inspection plan in 1955. But the United States does not need Soviet consent to put satellites on peace patrol, any more than the Soviets needed U. S. permission to send their Sputniks and Vostoks over American territory. (At 10:55 a.m. last August 5, when the orbiting Vostok II passed directly over Washington, D. C., it carried not only a man, Gherman S. Titov, but also a camera.)

The Russians have referred acidly to the space sentries as "Peeping Toms." But, as Lt. Gen. Roscoe C. Wilson, Air Force chief of development, says, "Samos and Midas are passive systems—they present no offensive threat. Like a burglar alarm, they threaten only would-be transgressors."

If wisdom even remotely comparable to the ingenuity that is going into the design of the space-sentry systems can be applied to their use, cooperative global arms inspection and an open planet are within reach. The intelligence satellites could be the instrument of a "push-button peace."

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